Benchmarking Sustainability Performance of Espoo with Selected EU Cities

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Benchmarking Sustainability performance of Espoo with selected EU cities

A 2017 benchmark study of 15 selected high scoring cities in Northern Europe, prepared for the city of Espoo, Finland

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Summary

In this study, carried out as a joint project of the city of Espoo and Telos-Tilburg University, the sustainability performance of Espoo is assessed. The study uses 87 indicators and compares the outcome in reporting year 2017 with data collected from two angles, 1) the performance in the previous reporting year 2016 and 2) the performance of 14 benchmark cities in 2017. The group of benchmark cities is selected by Espoo and covers major prosperous cities in the northern and middle part of the EU, including e.g. Amsterdam, Berlin, Copenhagen, Helsinki and Stockholm.

The method used has been developed by Telos and was previously applied to an EU city study in 2016 covering more than 100 cities. The method measures for the social, ecological and economic domains (called capitals) of sustainability the degree to which sustainability goals defined by Telos experts are achieved (varying from 0-100%).

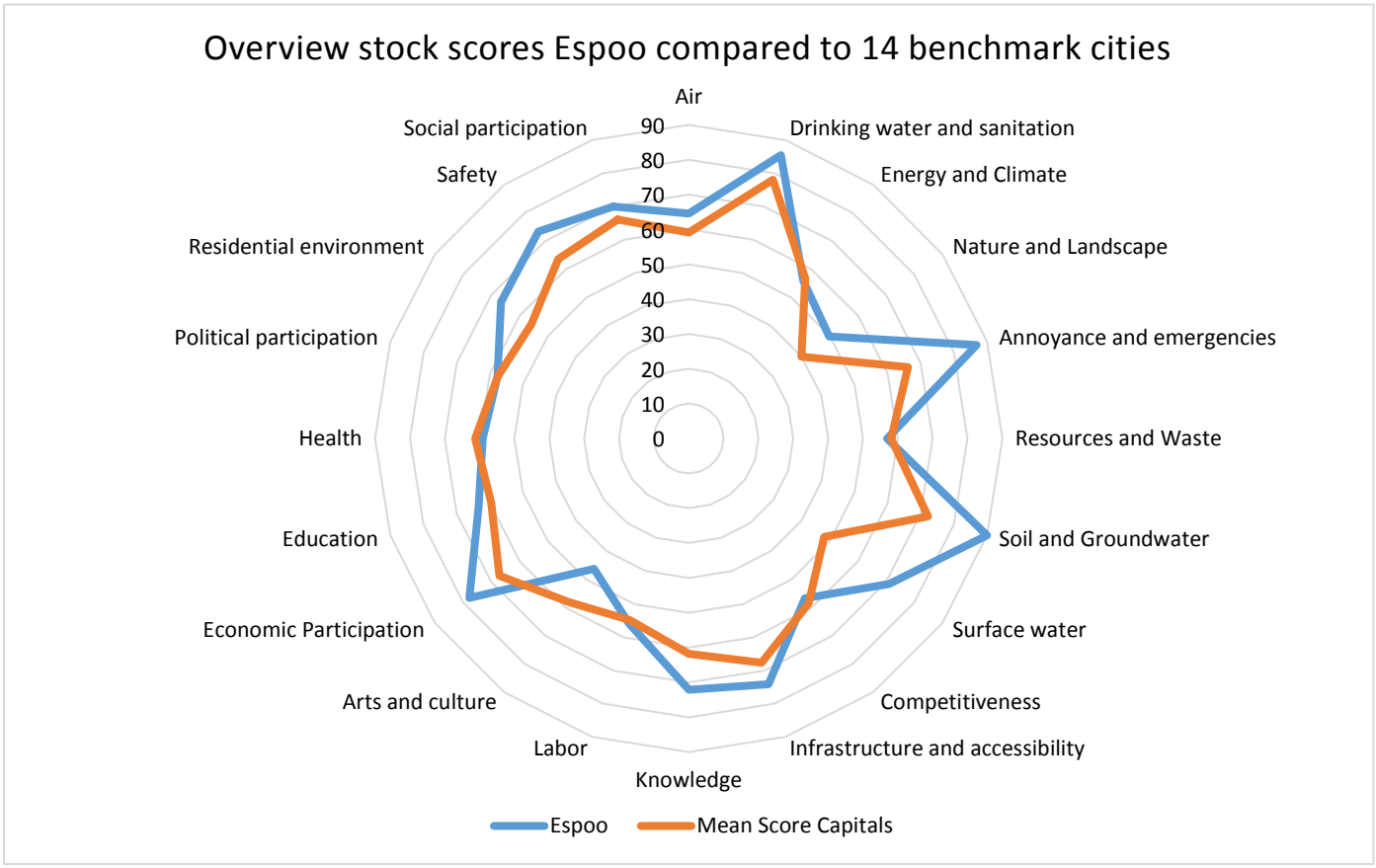
It was not possible to obtain updated measurements for all 87 indicators used. The result is that for nearly half of the indicators more recent data than published in 2016 has been included. In cases where no new data were available in 2017 the same values as reported in 2016 have been used.

Espoo maintained its top position among the benchmark cities in 2017 although the total sustainability score declined from 66.7 to 66.3. The ecological capital score improved, but the score of the social and economic capitals declined. Social capital decline was mainly related to lower scores for Social participation, Economic participation and Health, while the small decline in economic capital score was related to somewhat lower scores for Competitiveness and Knowledge. The improved ecological score was mainly related to better Waste handling.

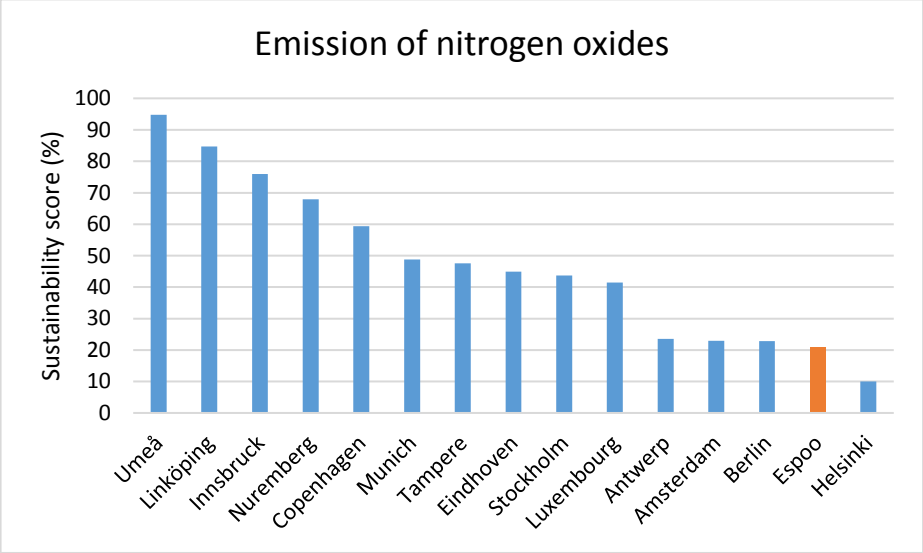
A detailed analysis at indicator level has been made to identify the most favorable and unfavorable scoring indicators. These have been listed in chapter 4 by using circle diagrams with colors. Five indicators, mainly ecological ones, were scoring very low (red), while 14 were scoring low (orange) of which the largest part (6) belonged to the social capital. This total group of 19 indicators provides a potential priority list for policy actions. The list may however also contain indicators that are difficult or impossible to change. To filter these out as much as possible the

situation in Espoo is compared in chapter 5 with the outcome for the benchmark cities.

The following figure shows for the themes (stocks) that constitute the three capitals the scores of Espoo and compares these with the average stock results for the group of 14 benchmark cities (orange line).

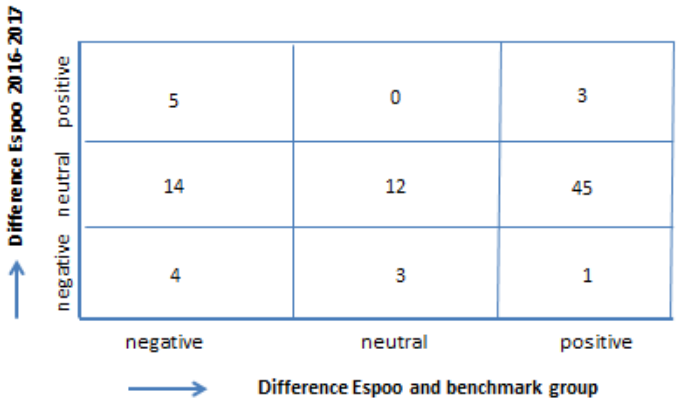


Espoo performs less than the benchmark group for Energy and climate, Resources and waste, Annoyance and emergencies, Competitiveness, Arts and culture and Health. For low scoring indicators in Espoo, compared to the benchmark group, specific comparisons have been made. An example, emission of nitrogen oxides, is presented below.



In the final chapter 6 the results have been combined to detect potential policy priorities from both angels, the changes between 2016 and 2017 and the comparison between Espoo and the benchmark cities in 2017. A summary of the number of indicators showing negative, neutral or positive dynamics in those two comparisons is presented in the next table.

The relative position for Espoo indicators in a combined benchmark and 2016-2017 change matrix



Indicators of highest interest are those where Espoo performed unfavorably in comparison with the benchmark cities and showed a lower performance in 2017 than in 2016. The following 4 indicators belong to this group:

- Employment Growth
- Hospital beds available
- Satisfaction with hospitals
- Perception of foreigners

Lower scoring indicators in Espoo compared to benchmark cities that remained unchanged since the previous year (this can be also due to the absence of new measurements), are the following 14 indicators:

- NO2 concentration in air
- NOx emissions
- Reduction Target CO2 emission
- Agricultural Area
- Red Area
- Distance to airport
- Satisfaction with living in the city
- Employment Function
- Libraries
- Museum visitors
- Theaters
- Tourism overnight stays
- Municipal Elections turnout
- National Elections turnout

This outcome is the result of a desk study and not yet assessed against the background of practical circumstances in Espoo. The Availability of hospital beds indicator, for example, is scoring low although high quality beds may be available at the moment in Espoo. For the CO2 reduction target 2020, the report has based itself on data reported in the framework of the Covenant of mayors. For reasons of comparability more recent decisions in 2016 to reduce CO2 emissions further have not yet been included in the report, but will improve the Espoo score further. Similar detailed analyses may lead to selecting appropriate policy actions using the outcome presented as a potential checklist for action.

Where Espoo strives to further improve and maintain its top position in sustainability, the listed 18 indicators are good potential areas for policy action. The 14 benchmark cities may have interesting approaches on these sustainability areas that can inspire Espoo to take further actions. Also more detailed analysis of the socio-economic and environmental interactions within and between Finnish regions may help find key potencies for improvement. Examples in the Netherlands may assist in developing this field of research and policy making.

Considering the results in retrospect, some difficulties have become clear for which in the future better approaches may be developed. It is a major drawback that Espoo is not included in the Perception survey of Eurostat. Obviously it is not very satisfactory to use estimates for the perception of sustainability issues in Espoo by using data from Oulu and Helsinki. It could be explored if Espoo can buy itself in in the periodic process of the EU Perception survey. Furthermore, when this tool is used to monitor actual improvements and challenges of sustainability policy of Espoo and its region, it is not so helpful if data are used that are referring to the situation of several years ago. This could be overcome by e.g. organizing a tailor-made monitoring system among a group of participating cities that have a similar attitude towards sustainability and willingness to invest in a rapid exchange of data to support the governance of sustainability of their cities. This monitor can be a useful prototype for such an exercise.

1 Introduction

1.1 Study background

The study is an initiative of the mayor of Espoo, Jukka Mäkelä, after taking note of the presentation of the Telos study 'Towards Sustainable EU Cities, A quantitative benchmark study of 114 European and 31 Dutch cities' (Zoeteman et al., 2016), which was presented at the *Smart & Clean Seminar* on 23 May 2016 in Helsinki. This study was prepared for the Dutch Presidency of the EU 2016 and financially supported by the Dutch Ministry of the Interior and Kingdom Relations, The Hague, the Netherlands. The outcome of the study showed that Espoo was the best performing city of the total group of 114 EU cities studied. Espoo was interested to learn more about the specific city characteristics that would benefit from further improvements to allow the city, together with its region, to keep its top position in the field of sustainability.

During a meeting on 9 July 2016 in Eindhoven, the Netherlands, mayor Jukka Mäkelä and Harri Paananen of Espoo met with prof dr Pieter Tordoir, scientific director and prof dr Kees Zoeteman, project manager of Telos, Tilburg University. During this meeting Telos illustrated how the present monitoring tool could be further developed as a tailor-made instrument for the ambitions of the region and the city of Espoo. Furthermore it was demonstrated how the socio-economic interactions within the region can be analyzed and used to identify socio-economic geographical clusters and their interactions, as a basis for optimizing future developments and the sustainability performance of the region as a whole. The mayor asked Telos to prepare a proposal for a tailor-made monitoring exercise. After several rounds of discussion a final tailor-made monitoring project was agreed in December 2016, that is a joint exercise of the city of Espoo and Telos.

1.2 Setup of the report

Chapter 2 will further define the challenge of developing the tailor-made monitor for Espoo. Chapter 3 briefly summarizes the methodology used, which is essentially the same as the method used for the earlier mentioned EU cities study. Chapter 4 describes the way the task at hand has been executed, while chapter 5 shows the general results of the monitor for Espoo in the reporting

years 2016 and 2017. Chapter 6 looks at the results of Espoo in reporting year 2017 in comparison with the group of benchmark cities. Chapter 7 makes a start with the analysis of the outcome for the group of benchmark cities and looks for factors that may explain relative differences within the group of 15 cities studied. In final chapter 8 special attention is given to issues that may be further improved in Espoo and in the methodology.

2 The Challenge

2.1 The choice of reference years

The primary added value of a sustainability monitor is that it describes the scores in a city for each of the three sustainability pillars or, as these are called in the Telos method, the three sustainability capitals. Imbalances between economic, social and ecological aspects become visible in this way and politicians responsible for the different policy areas obtain a common framework or language to compare the results in their fields and can collectively design policy priorities.

A second advantage of periodic sustainability monitoring is that it allows to detect changes from year to year. This helps to detect where goals are met or where additional policy efforts have to be developed. The previous EU city monitor was issued spring 2016. For a number of indicators new data have become available but certainly not for all indicators included.
Yet, it was decided to show changes between the reporting years 2017 and 2016. The details of the indicators and data included in both reporting years are described in the next chapter.

2.2 The choice of benchmark cities

A third advantage of sustainability monitoring can be the provision of a wider reference framework for designing action by benchmarking selected cities among each-other. In this case Espoo has selected as benchmark 14 cities that are seen as competitors or leaders to follow in certain areas. Espoo has chosen the benchmark cities listed in Table 2.1 for this monitor.

Half of the benchmark cities are located in Nordic countries and vary greatly in size and population density. The smallest city in the benchmark group is Luxembourg with 104,000 inhabitants, while Berlin is with 3.5 million inhabitants the largest one. Population density varies greatly from 5 per km^2 in Umeå till 4,630 per km^2 in Munich. All cities are growing and relatively wealthy. It should be noted that population density and GDP/capita data apply to the wider urban zones of the cities (NUTS 3), as only at that level recent data were available.

Table 2.1 Espoo and the benchmark cities included in the monitor study

No	City	Country	Population in formal city limits (x1000)	Population* density (n/km^2)	GDP/cap* (1000 €)
1	Amsterdam	Netherlands	811	1,858	93.3
2	Antwerp	Belgium	514	1,079	66.7
3	Berlin	Germany	3,470	3,918	33.0
4	Copenhagen	Denmark	559	4,170	104.0
5	Eindhoven	Netherlands	221	524	122.4
6	Espoo	Finland	261	177	39.9
7	Helsinki	Finland	613	177	39.9
8	Innsbruck	Austria	122	145	93.6
9	Linköping	Sweden	147	42	106.8
10	Luxembourg	Luxembourg	104	220	74.2
11	Munich	Germany	1,430	4,630	156.6
12	Nuremberg	Germany	501	2,718	127.5
13	Stockholm	Sweden	864	339	47.6
14	Tampere	Finland	220	40	74.9
15	Umeå	Sweden	116	5	61.2

*These data apply to the NUTS 3 area related to the city

3 Methodology applied for urban sustainability monitoring and sources for data retrieval

3.1 The key elements of the Telos sustainability benchmark method

The sustainability assessment instrument uses, as mentioned before, three pillars of sustainability (the ecological, socio-cultural and economic capitals) and their constituting subsystems. Following the UN Brundtland Commission report of 1987 and the UN Sustainable Development Goals (SDGs) renewed in 2015, sustainable development implies that there must be simultaneous improvement of all three capitals. The improvement of one type of capital must not occur at the expense of one or both of the other types. Sustainable development not only includes development of the social, ecological and economic capitals, but also refers to dimensions of time (now and later) and space (here and there).

In total 17 SDGs have been formulated covering the three sustainability capitals as well as governance aspects. For this monitor, governance aspects have not been included. The focus is on the so-called 3P sustainability approach.

In order to be able to monitor the development of each form of capital and their relative positions, these have been broken down into subsystems called “stocks” using soft systems modelling (Checkland and Scholes, 1990). These stocks are important to the state and development of each form of capital, as well as to the system as a whole (see Figure 3.1).

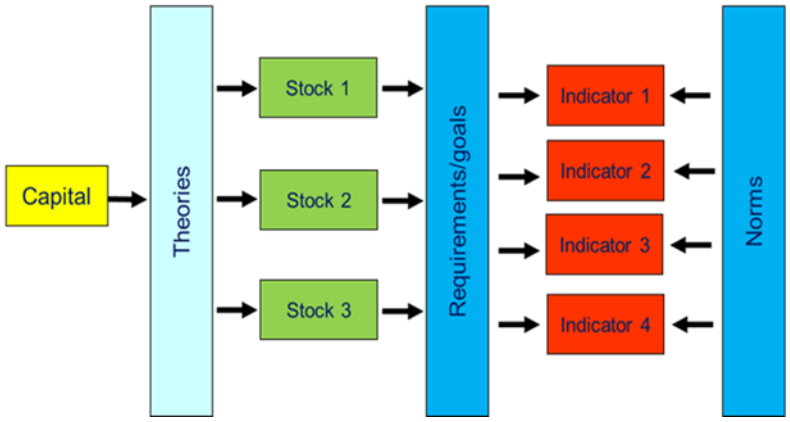


Figure 3.1 Construction of sustainability capital scoring, using stocks, goals, indicators and their sustainability norms

The sustainability assessment instrument delineates stocks such as soil, water and air for ecological capital; social cohesion, health and education for socio-cultural capital; and labor, infrastructure, and knowledge for economic capital. To develop sustainably, the stock values need to move in a certain direction towards a theoretically determined maximum goal. In this context, a number of long-term goals, called “requirements,” were formulated by the research team for each of the stocks; wherever possible, this was done in co-operation with stakeholders. These requirements are important reference points for the sustainability assessment instrument, as they represent the long-term sustainability vision of the region or municipality. Ideally, they are the result of an interactive process that involves different stakeholders aiming to develop a common vision; in most cases, however, it is not very difficult to reach consensus on long-term requirements. Examples are: (i) for the *soil* stock in ecological capital, the requirement is that the soil and groundwater are clean; (ii) for the *safety* stock in sociocultural capital, one requirement is that everyone living in a municipality should feel safe, and another is that the chance of becoming a victim of burglary should be negligible; and (iii) for the stock of *labor* in economic capital, the requirement is that labor market should be balanced (qualitatively and quantitatively) and work should be healthy (long-term illness and disability should be avoided).

The degree to which sustainability requirements are being met is measured using indicators. The development of indicator values over time provides an insight into the direction of development. A sustainability norm is specified for each indicator. The selection of indicators and their norms is often more sensitive to authorities than the definition of the long-term requirements discussed above. For the benchmark study discussed in this paper, the researchers selected the indicators and their norms based on literature and past experience, and these were subsequently applied to all cities. Table 3.1 summarizes the terms used and their definitions.

Table 3.1 Terms used to describe the sustainability of municipalities

Term	Description
Capital	The three essential subsystems of the entire social system: the ecological, sociocultural and economic aspects.
Stock	The essential subsystems which together with other stocks determine the quality and quantity of one form of capital.
Requirement	Long-term goal(s) that specifies or specify the sustainability challenge for a stock.
Indicator	Measurable characteristic that can be used to operationalize the requirement.
Norm	Sustainability standard by means of which the scores on indicators can be quantitatively assessed and expressed as % of long-term goal achievement. Four ranges are defined between 0-100% and shown in circle diagrams with the colors red-orange-green-gold; see figure 3.2

Figure 3.2 visualizes an example of a circle diagram which shows indicator scores between 0 - 100% of a stock, using their norms.

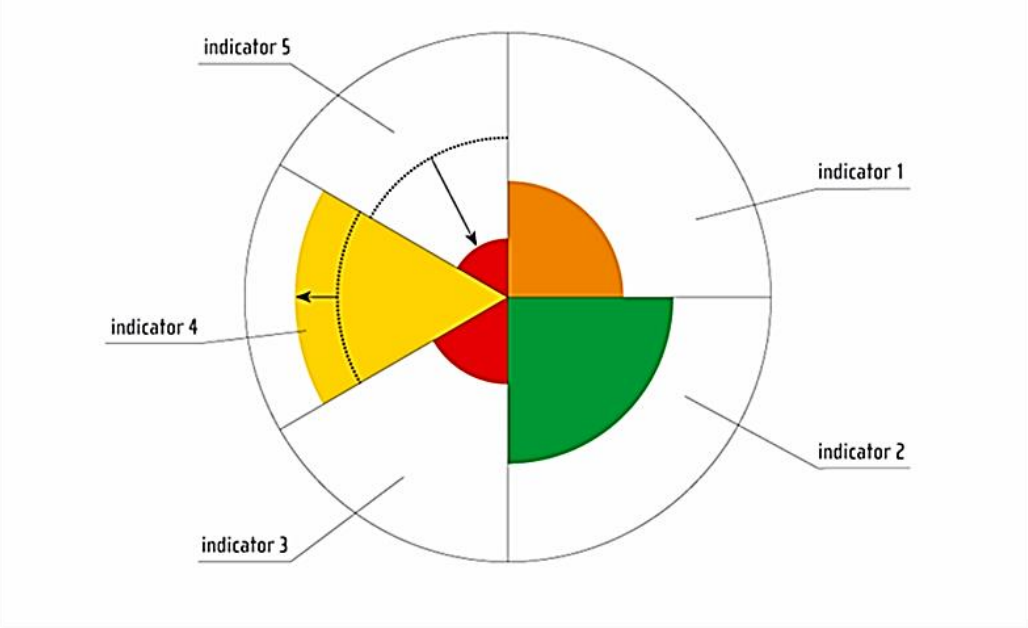


Figure 3.2 Circle diagram showing indicator scores within a stock; colors given (red-orange-green- gold) are based on the norms used for assessing indicator values measured; arrows show the change compared to a previous period; scores increase from 0 till 100% goal achievement from the center to the periphery.

Municipalities are considered more sustainable when the total sustainability score is higher and the deviation of the individual capital scores from the average, based on the total score, is smaller. Sometimes municipalities have a high score for one form of capital (e.g. an economic capital score of 60% achievement of the sustainability goal), while the other two forms of capital score much lower (e.g. 35% and 40%). Time series analysis will be able to determine whether the type of capital scoring higher is developing at the expense of the other two types. A relatively low-scoring capital will trigger the attention of the authorities, prompting them to analyze the causes and consider remedial policy actions.

3.2 The actual design of the scoring instrument

Sustainability requirements have been defined for each of the stocks of the three capitals in Annex 1. This was done by the Telos team based on local, regional, national and European policy documents and the actual performance of major cities in the EU. Subsequently, indicators were selected for each stock, based on the requirements. Table 3.2 gives an overview of the 20 stocks distinguished and the 87 indicators used to measure their performance.

Table 3.2 The 3 capitals, 20 stocks and 88 indicators used to assess municipal sustainability

Capital	Stock	Number of indicators	Type of indicators
Ecological	Soil and groundwater	2	Chemical status groundwater, Nitrogen surplus in soil
	Drinking water and sanitation	4	Public water supply consumption, Household consumption, People connected to wastewater collection system, People connected to secondary or better wastewater treatment
	Surface water	4	Soil sealing, Ecological status, Chemical status, Increased flood risk due to heavy rainfall
	Air	7	Concentration of ozone, PM10 and PM 2.5; Annual emissions per capita of nitrogen oxides (NOx) and ammonia (NH3); NO2 concentration; Perception of seriousness of air pollution
	Annoyance and emergencies	6	Road-, Rail- and Airport noise >55dB and >65dB, Perception noise annoyance
	Nature and landscape	6	Urban green area, Urban blue area, Urban red area, Agricultural area, Natura 2000 area, Quality of natural area
	Energy and climate	3	Annual GHG emissions in CO2 eq. per capita, Emission reduction target 2010-2020
	Resources and waste	5	Annual municipal solid waste generated per capita, Landfilling %, Incineration %, Incineration % with energy generation, Recycling %
Socio-cultural	Economic participation	2	Long-term unemployment rate, Poverty
	Political participation	4	Turnout municipal, national and European elections, Political trust
	Social participation	2	Perception that foreigners are good for society, Perception that most people can be trusted
	Health	5	Infant mortality, Hospital beds, Availability General Practitioners, Life expectancy, Satisfaction with health facilities
	Arts and culture	5	Museum visitors, Theaters, Satisfaction with cultural facilities, Nights spent in tourist accommodations, Public libraries
	Safety	5	Intentional homicide, Burglary, Robberies, Traffic fatalities, Perception of safety
	Residential environment	5	Net migration, Rental price, Satisfaction with living in this city, Satisfaction with house, Satisfaction with sports facilities
	Education	4	Youth unemployment, Early leavers from education, Secondary education, Satisfaction with schools
Economic	Labor	4	Employment rate, Unemployment rate, Employment function, Aging labor force
	Competitiveness	5	Disposable income, Starting businesses, Ended businesses, GDP/capita PPS, Employment growth
	Infrastructure and mobility	6	Broadband connection internet, Length of cycle lanes, Congestion of motorways, Distance to closest major airport, Cars registered, Satisfaction with public transport
	Knowledge	4	High (tertiary) education, Employment high technology, Employment creative class, R&D intensity

The number of indicators used in this study was limited by the availability of data but also by the fact that adding more indicators to measure a certain stock adds less and less to the outcome. In the 2017 report small changes have been made compared to the list of 86 indicators presented in the 2016 EU cities report. Added are the air pollutant nitrogen dioxide (NO_2) and a waste recycling indicator and deleted is the indicator realized CO2 reduction between 1990 and 2010. This is a fixed indicator that cannot change from year to year and is therefore not useful for the annual comparison.
Finding useful indicators depends, for example, on the availability of data for all of the cities involved, their comparability in space and time, and the frequency of measurement of the indicators. Having determined the indicators that could be used, a scale for each was constructed using a set of specific norms for each indicator that measures progress towards sustainability, expressed as a percentage of the operational sustainability goal of that indicator (varying from 0%, the lowest and unacceptable score, to 100%, the highest achievable long-term score). One example of such an indicator for the labor stock concerns the level of unemployment in the labor market. The sustainability goal for the labor stock is that the labor market should be balanced (quantitatively and qualitatively). The level of unemployment indicates whether the labor market is quantitatively in balance or not. An unemployment level below 4% is considered socially optimal (equivalent to an indicator score between 75% and 100%), between 4% and 7% socially acceptable (an indicator score between 50% and 75%), between 7% and 10% socially alarming (an indicator score between 25% and 50%) and above 10% socially unacceptable (an indicator score between 0% and 25%). An unemployment percentage of 4.2% is thus a socially acceptable result, leading to an indicator score of 73%.

Applying this assessment method, each actual indicator score is expressed as a percentage representing the degree of achievement of the sustainability goal. A total score for each stock is determined by adding the weighted scores of the indicators involved. A general example of how the weighting of indicators for one stock was done is given in Table 3.3. In the present study indicators have been given equal weight within a stock.

Table 3.3 Example of weighting indicators in calculating a stock score when requirements are of equal importance (weighting in %)

Measurement terms			**Weighting in %**
Stock 1	Requirement 1	Indicator 1 Indicator 2	25.00 25.00
	Requirement 2	Indicator 3 Indicator 4 Indicator 5	16.67 16.67 16.67
			100.00

An extended description of the method used can be found in Zoeteman, Van der Zande and Smeets (2015) and Zoeteman, Mommaas and Dagevos (2015).

The stock scores are then added, with equal weight, to calculate the capital score. Finally, the three forms of capital are weighted equally to calculate the overall sustainability score for a city, expressed as the average percentage of the overall achievement of sustainability goals.

3.3 Availability of data and data estimations

The data used in this study were obtained from Eurostat, ESPON, the European Environment Agency (including the Urban Atlas), the European Cities Monitor (Cushman and Wakefield, 2011), the Covenant of Mayors website, the EC DG Regional and Urban Policies, the EC DG Environment, the WISE WFD Database, and the websites of the cities concerned. Annex 2 describes the indicator definitions and data used. Some data could only be obtained at NUTS 2 or NUTS 3 level. In such cases, they were translated to city level, for example, by allocation of a proportional part of the indicator value from the NUTS level extrapolated to the city level according to the population size. In exceptional cases, particularly those relating to perception surveys, data from one or more other cities of the same Member State were used. These cases are described in Annex 3. Finally, some extra information obtained from the city of Espoo was used occasionally.

3.4 Updating of data reported in 2016

It was not possible to obtain updated values for all 87 indicators used. The result is that for nearly half of the indicators more recent data than published in the 2016 report has been included. In cases where no new data were available in 2017 the same values as reported in 2016 have been used.

4 Results for Espoo in the reporting period 2016 - 2017

This chapter will show the outcome of the sustainability scores in Espoo for reporting year 2017 compared to reporting year 2016. After discussing the results for the total scores, the capital scores and the stock scores, a detailed presentation at the level of the indicators will be given. In general, it should be noted that perception data were not available for Espoo. To not exclude such data from the benchmark study, perception data for Oulu and Helsinki, the only Finnish cities in the Perception Survey, have been used instead. These data may differ from those actually occurring in Espoo.

4.1 The overall situation in the reporting year 2017 compared to 2016

Figure 4.1 shows for Espoo the differences for the total and capital scores between reporting years 2017 and 2016. The total sustainability score decreased somewhat from 66.7 to 66.3. This is the overall result from a decrease in the social and economic capital scores and an improvement of the ecological capital score. Particularly the social capital decreased as will be further discussed in the next paragraphs.

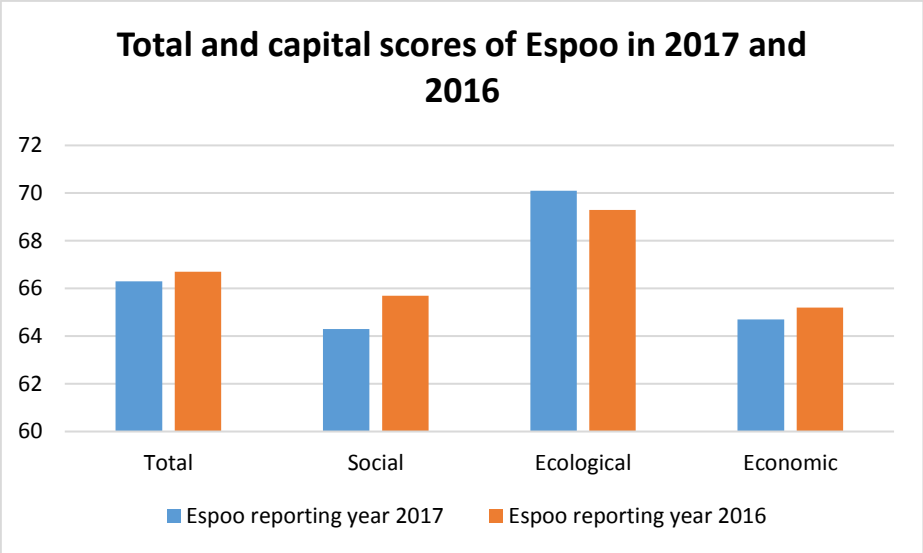


Figure 4.1 Total and sustainability capital scores for Espoo in 2017 and 2016

4.2 Differences in stock scores

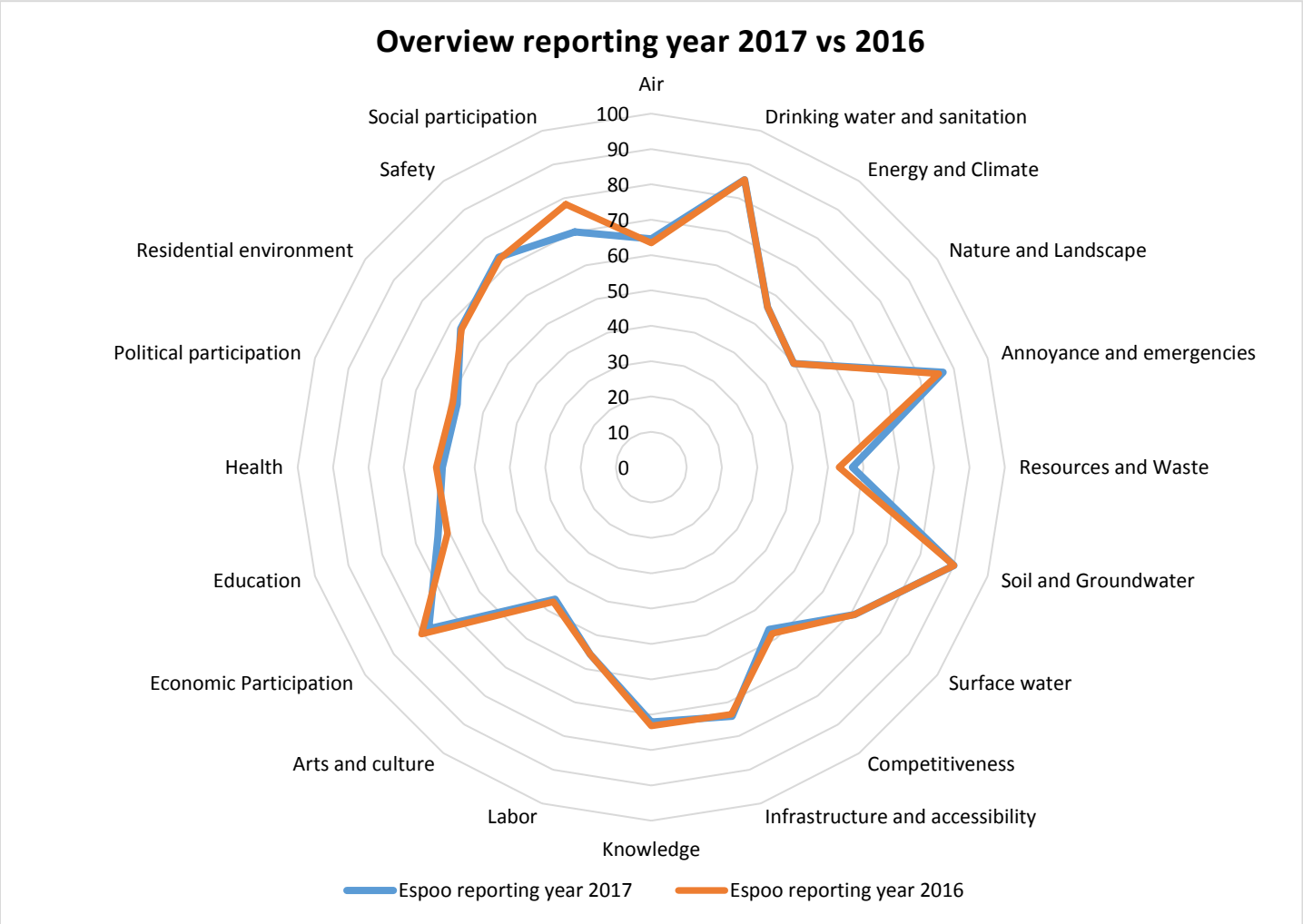


Figure 4.2 Stock scores for Espoo in 2017 and 2016

As figure 4.2 shows, stock scores are in many cases not so much different in reporting year 2017 from those in 2016, with one exception: the stock Social participation. This stock score was considerably lower in 2017. To a lesser extend this also applies to the stock Health. Minor reductions were also detected for Competitiveness and Knowledge. Improvement among the ecological stocks was particularly found for Resources and waste.

From a general point of view lowest stock scores are found for Nature and landscape, and for Arts and culture. Highest scores are found for Drinking water and sanitation, Annoyance and emergencies, Soil and groundwater, and Economic participation.

4.3 Shifts in indicator scores

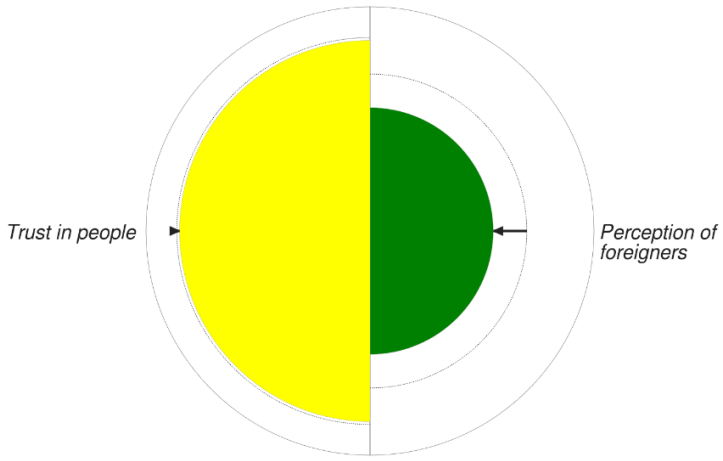
This paragraph will discuss the indicators for each of the three capitals as available in 2017 compared to 2016 (eventual difference indicated by arrow in figures). Indicators will be clustered according to the stocks they belong to. The results shown in this paragraph will provide the most detailed clues for possible policy initiatives to improve sustainability performance in Espoo.

4.3.1 Indicator scores of the socio-cultural capital

Social participation indicators

People develop themselves by participating in networks, it gives them access to resources which they cannot reach individually. That can be networks within small, more or less closed units (family, school, sport clubs), as well as larger and more open networks. Participation in social networks is important for the welfare of people. Confidence in other people is needed for this involvement in networks.

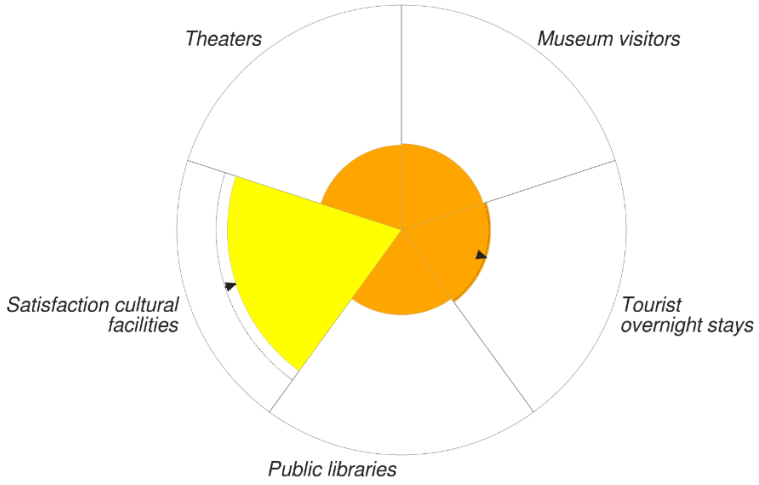
Citizens of Espoo score high on the indicator trust in other people. On the other hand perception of foreigners scores lower, although the score is relatively good. This trust has strongly decreased in comparison with the previous reporting year. This can be due to the recent increasing refugee flows or the extra media attention. Both perception data represent the average for Finland (Oulu and Helsinki) and may deviate from the actual situation in Espoo which is not included in the EU Perception Survey.



Arts and culture indicators

Arts and culture are related to the existing norms and values within the socio-cultural capital. They protect, represent and re-embed established cultural expressions (heritage). The stock Arts and culture is measured by objective figures on numbers of visitors and cultural aspects of tourist overnights stays. Also subjective satisfaction of cultural facilities in the city is included. The availability of arts and culture in the living environment has different positive effects for the local community. First of all a varied offer of arts and culture makes the environment attractive for residents. Secondly, it can be an attraction for people outside the community (tourists, new residents) and can lead to improving welfare.

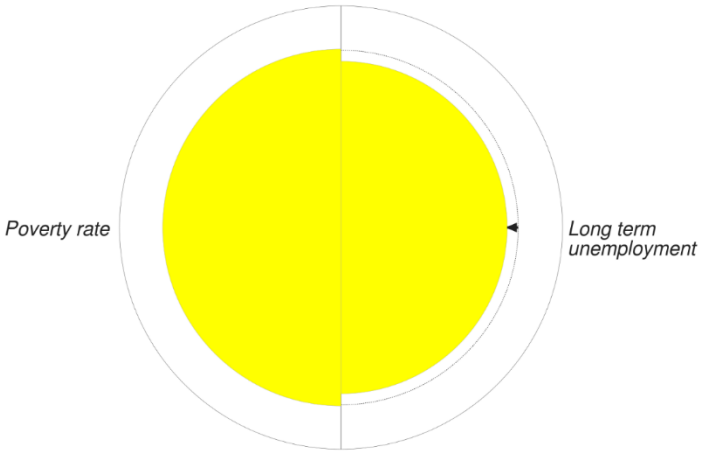
The stock Arts and culture shows a divers picture. The number of visitors of museums, theaters and public libraries is relativity low. Also tourist overnight stays shows a low score. Espoo has a low attraction on tourists to stay overnight, probably because of the vicinity of the larger Helsinki.



Economic participation indicators

Having a job is one of the most important principles of our Western society. It gives the opportunity to provide an income. Secondly, it contributes to the desire of people to develop themselves and it gives access to social networks.

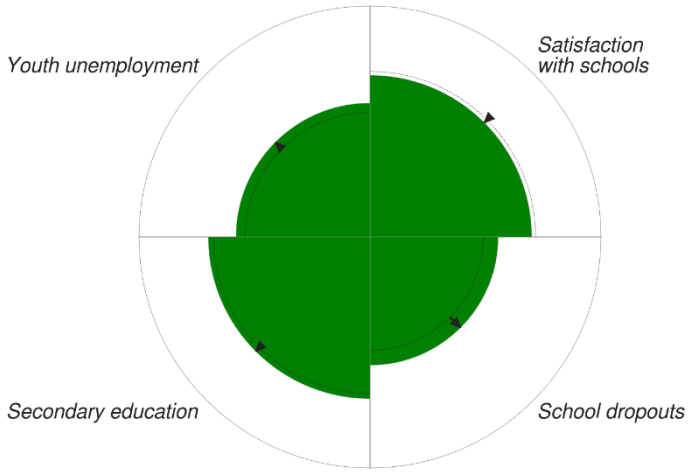
Economic participation in Espoo scores high. Both poverty rate and long term unemployment score very high. Almost all residents of Espoo live above the poverty rate. Also the long term unemployment indicator scores very high, although a bit lower than the previous reporting year.



Education indicators

Education is key for developing our (knowledge) society and focuses on transferring knowledge, skills and attitudes. Education has three main functions: qualification, selection and socialization. Formal education usually takes place in existing educational institutions, but also happens in more informal settings like family, sport clubs and community centers. Education needs to be developed constantly in order to meet social needs and needs of the job market. For the youth, it is important that sufficient opportunities for good education are available in the municipal region. In addition, young people need sufficient opportunities to enter the labor market after completing their education.

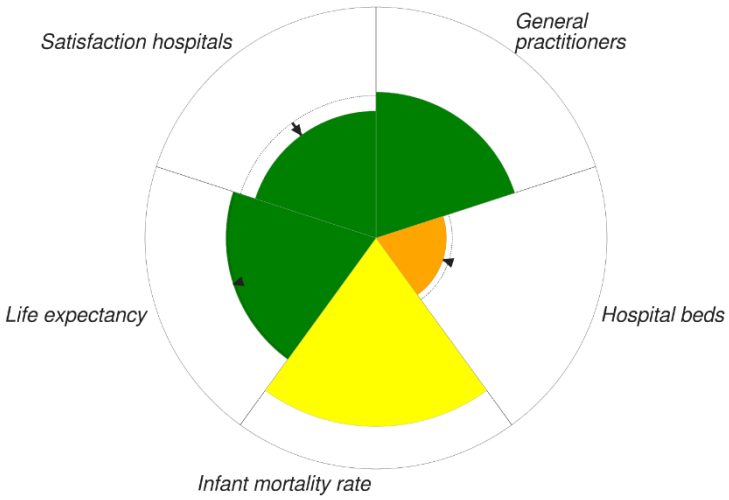
The stock education is showing overall a positive picture. The availability of secondary education is good and also the number of unemployed youths is low in Espoo. The number of school dropouts is relatively low and the satisfaction with the availability and quality of the schools is high. Most indicators improved somewhat last year.



Health indicators

One of the conditions for a sustainable society is a high mental and physical health of its residents. The responsibility of a healthy society is partly the job of the government, which should create conditions resulting in a good and accessible health care system.

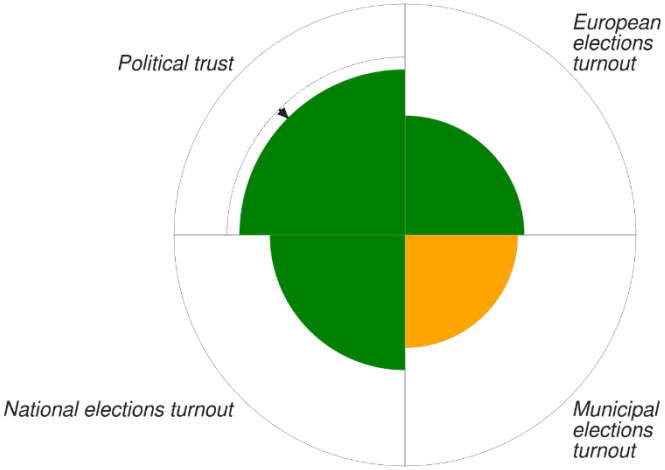
The stock Health shows a diverse image. The availability of hospital beds is relatively low in Espoo. This number has decreased in comparison with the previous reporting year, although the satisfaction of the hospital services by the residents is good. Espoo shows a high sustainability score on infant mortality rate and number of general practitioners in the city. Also life expectancy of the residents is high and a little improved relative to the previous reporting year.



Political participation indicators

People develop themselves by participating in networks; it gives them access to resources which they cannot reach individually. In addition, political participation revolves around the extent to which citizens are involved in decision-making that influences their living conditions. Confidence in politics and its institutions also plays an important role.

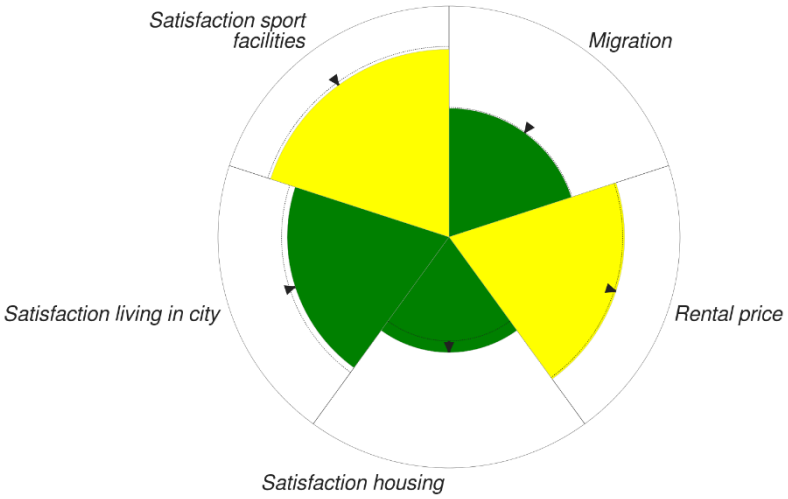
The numbers in Espoo are generally showing a positive picture. The turnouts on the National and European elections are high, although the turnout for municipal elections is somewhat lower. Although trust in politicians has decreased in Finland in comparison with the previous reporting year, this trust is still relatively high.



Residential environment indicators

The indicators of this stock give attention to the subjective rating of residents and the objective migration numbers and the average rental price.

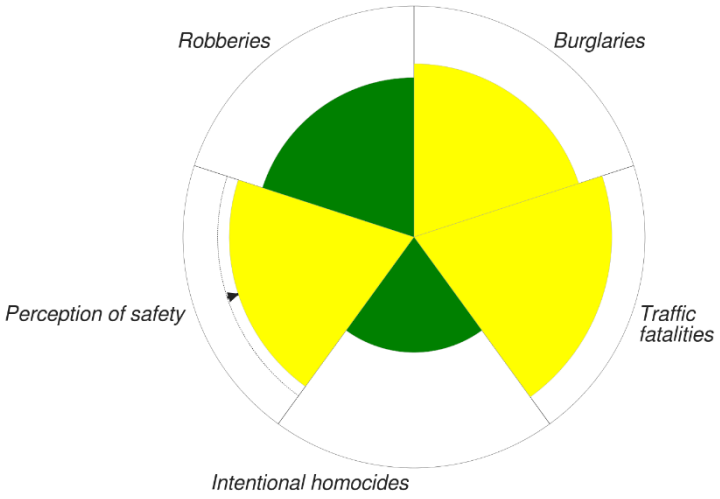
The picture of Espoo shows a positive outcome for the residential environment. Residents give a positive score to the availability of sport facilities and houses. They also give a positive score to the overall quality of living in Espoo, although this score has slightly decreased in comparison with the previous reporting year. It should be noted again that these perception data are not measured in Espoo itself but in Oulu and Helsinki. The migration rate (annual net migration per 1000 inhabitants) is positive, more people move into Espoo than move out. The average rental price shows to be fair.



Safety indicators

Both the individual civilian and society as a whole need a certain degree of safety to function. In the past decade, the subject of safety gained more importance in governmental policy making. The stock makes a distinction between objective safety numbers and subjective safety or the sense of security.

The numbers show for Espoo a positive picture. The numbers of burglaries, robberies and traffic fatalities are relatively low in Espoo. The number of intentional homicides are also relatively low, but a bit higher than for the other indicators. The perception of safety by the residents is probably also favorable as data for Finland indicate.



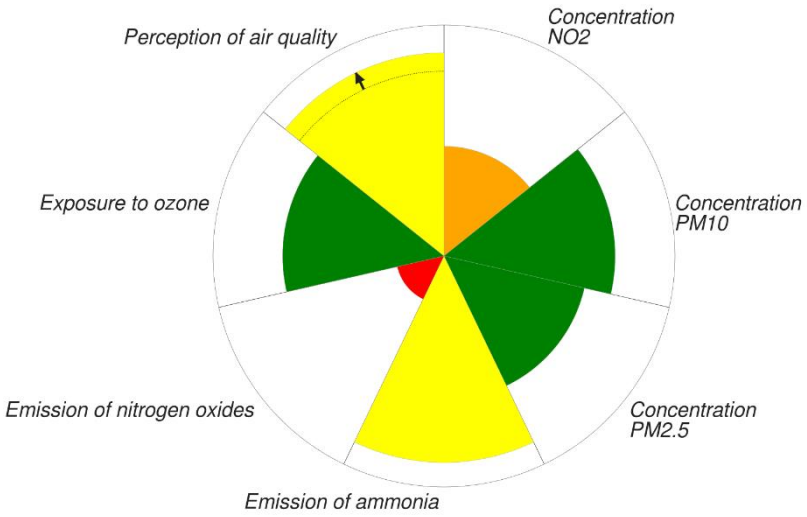
4.3.2 Indicator scores of the ecological capital

Within the ecological capital its different ecosystems are characterized for Espoo. These should be sufficiently resilient to overcome natural and human induced disturbances. Biotic elements, such as presence of plants and animals, and abiotic aspects including soil, water and air are included. These ecosystem stocks are strongly interrelated, but stocks of the ecosystem also show relationships with those of the two other capitals. Besides physical characteristics also perception estimates are included, for which the same restrictions apply as mentioned earlier.

Air indicators

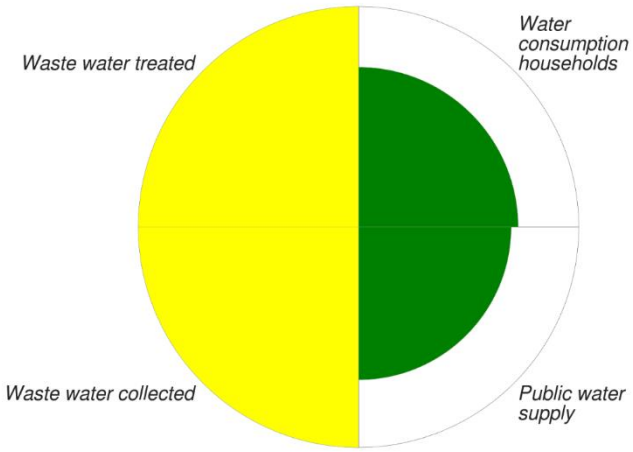
Air quality affects the health of people and the development of nature. Damage to the health of people is caused by both short-term exposure to high concentrations of pollutants and by long-term exposure to relatively low concentrations. For nature there are effects in terms of eutrophication and acidification of aquatic ecosystems. The air quality results from emissions released by almost all human activities. Sometimes these emissions have a local origin, but often the air quality is determined by long range transports of pollutants imported from abroad. Air quality thus plays on different geographical scales. At the local level high concentrations of particulate matter (PM10 and PM2.5) and nitrogen dioxide (NO2) can be problematic, while at global level CO2 emissions from combustion processes affect warming of the global atmosphere. CO2 emissions are included in the energy and climate stock.

Indicator scores of the air stock vary widely. Very favorable scores are found for perception of air quality and emissions of ammonia. Particulate matter scores and exposure to ozone score favorably. However, NOx emissions and particularly the resulting NO2 concentration score unfavorably.



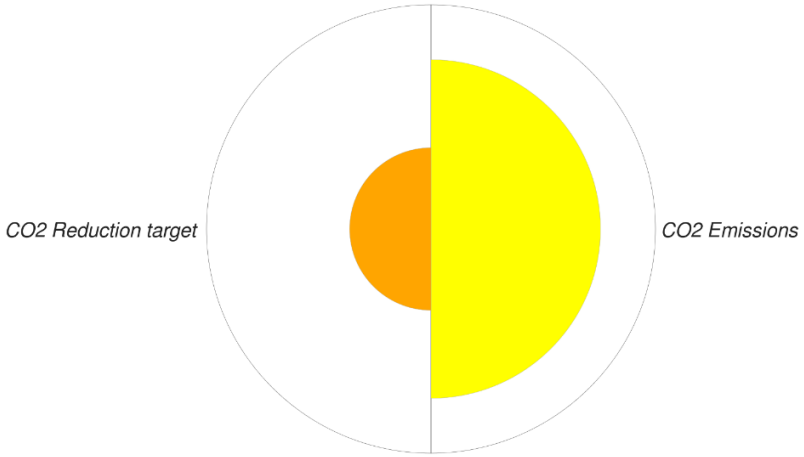
Drinking water and Sanitation indicators

Drinking water supply and sewage collection and treatment belong to the basic public services of modern society to secure public health. The indicators show that these aspects are well organized in Espoo, as may be expected from a wealthy city in Finland.



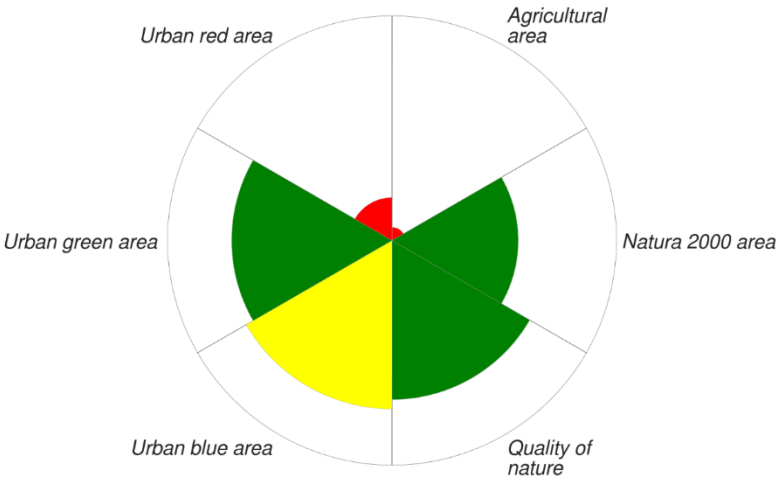
Energy and climate indicators

Greenhouse gas emissions (expressed in CO2 equivalents) show a favorable result at present. The data shown for the CO2 reduction target in 2020, as taken from the Covenenant of Mayors database, are less favorable. In time this indicator score will improve as Espoo has accepted in 2016 a more ambitious reduction target for 2030 which is however not yet included in the Covenant of mayors database, which is used for comparability reasons.



Nature and landscape indicators

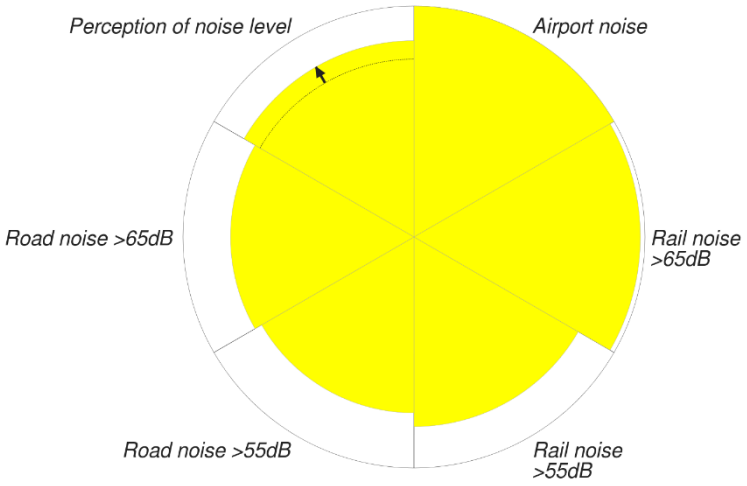
Except for the relative quantities of agricultural area and urban red area, nature and landscape indicators show a favorable performance. The large part of blue area of Espoo is a strong issue.



Annoyance and emergencies indicators

Noise pollution, for example, by industry, road, rail and air transport, can lead to disruption of sleep. This can lead to increased stress levels with cardiovascular disease and reduced learning performance of children

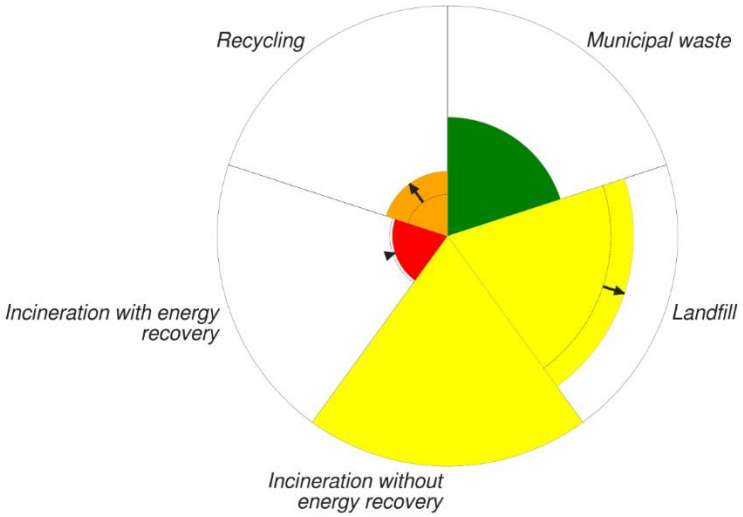
Noise level scores are very high for Espoo.



Resources and waste indicators

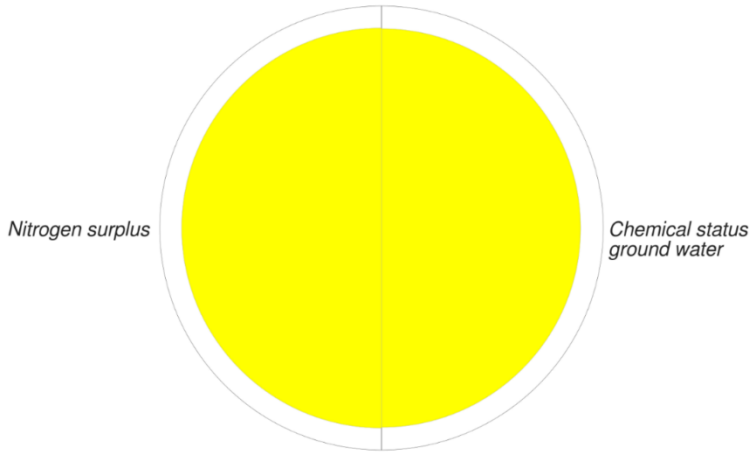
Recycling of waste helps to reduce the demand for virgin raw materials and energy. This reduces inter alia CO2 emissions. A circular economy also results in a lower supply of waste for incinerated or landfilling and the related environmental stress.

Espoo shows a very favorable performance for waste handling, including reduced use of landfilling and no incineration without energy recovery. The quantity of municipal waste generated is still relatively high and open for further reductions. Recycling and incineration with energy recovery can be substantially improved. It should be noted that the scores for incineration, landfilling and recycling are based on national data. In the future, more local data are desirable.



Soil and groundwater indicators

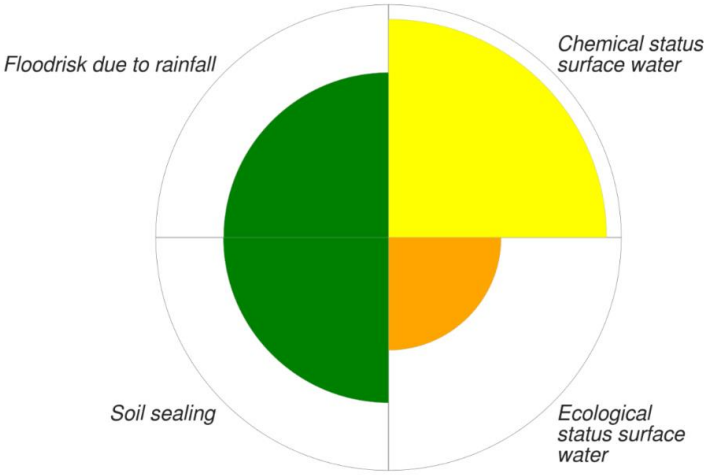
Soil and groundwater are in a very good condition in Espoo. Nitrogen or manure deposition on soil are low, also because few agricultural activities are taking place.



Surface water indicators

The stock Surface water is defined as that part of the surface area that (in principle) is covered with water. We distinguish flowing waters such as rivers and streams and waters such as lakes and ponds. The stock Surface water relates mainly to the quality of the surface water. In addition, and certainly against the background of the climate issue, the problem of flooding will also receive increasing attention. We restrict ourselves here to measuring the biological and chemical quality.

Surface water plays an important role in Espoo. Its chemical quality is high. Only its ecological status could be improved according to EU standards. The risk of flooding is low.

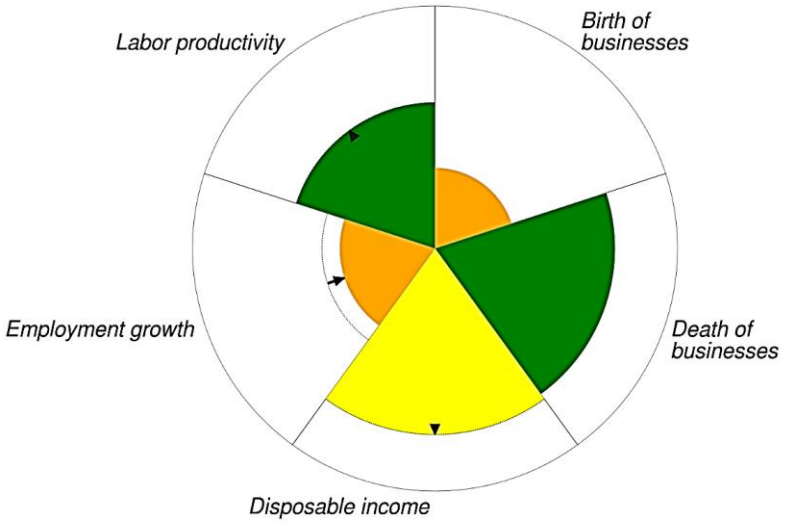


4.3.3 Indicator scores of the economic capital

Competitiveness indicators

The power of a local economy is largely determined by the actual activities of the city in the context of the larger region. This involves all companies, their composition and the resulting local and regional production structure. The composition has to be such that economic growth can be generated, but should also allow absorbing economic shocks. In addition, sufficient dynamism and renewal (starters, companies that are settling new in the region) have to be present. Companies must continually invest in the development of new products and services.

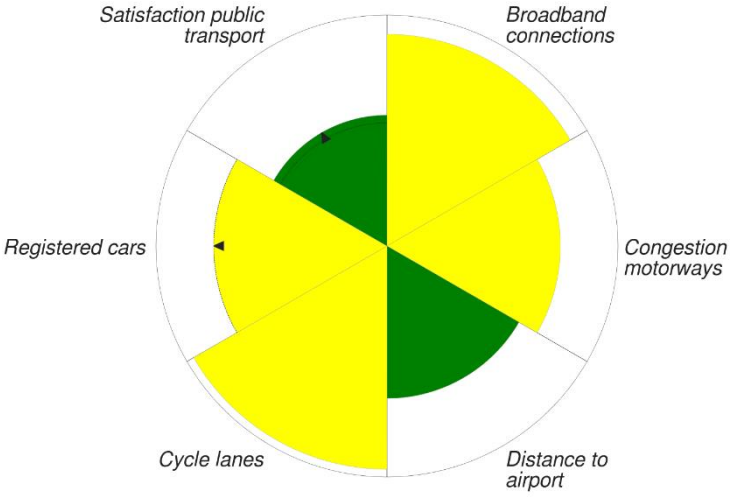
In Espoo the number of businesses that go bankrupt is relatively low, but on the other hand the number of startups in Espoo is low too. The indicator disposable income scores high as does labor productivity. On the other hand, employment growth is low and decreasing in comparison with the previous reporting year.



Infrastructure and mobility indicators

Infrastructure in all its forms plays a decisive role in promoting the economy as well as the social functioning of society.

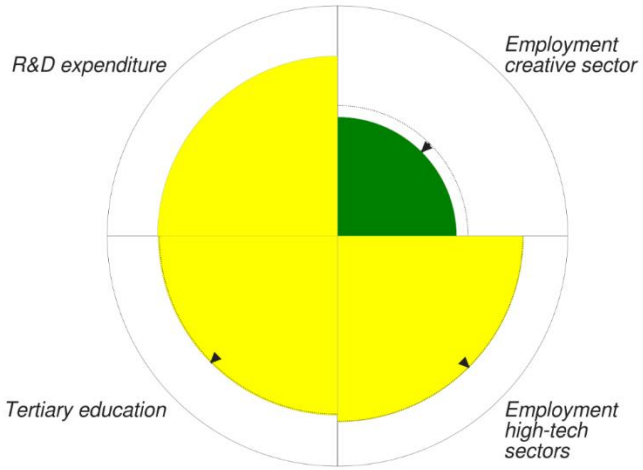
The stock infrastructure and mobility shows overall a positive image. It scores very favorable on the indicators broadband connection, congestion motorways, length of cycle lanes and number of registered cars. The latter is used as a positive indicator in this stock as it is a classical sign of an active economy. In the future public transport may be given in addition a role in this stock. The distance to the closest airport is also relatively low.



Knowledge indicators

Knowledge is a stock which mainly focusses on knowledge used in production processes and includes as well ‘embodied’ as ‘disembodied’ knowledge. Embodied knowledge involves having knowledge workers (human capital), while disembodied knowledge is knowledge incorporated in products.

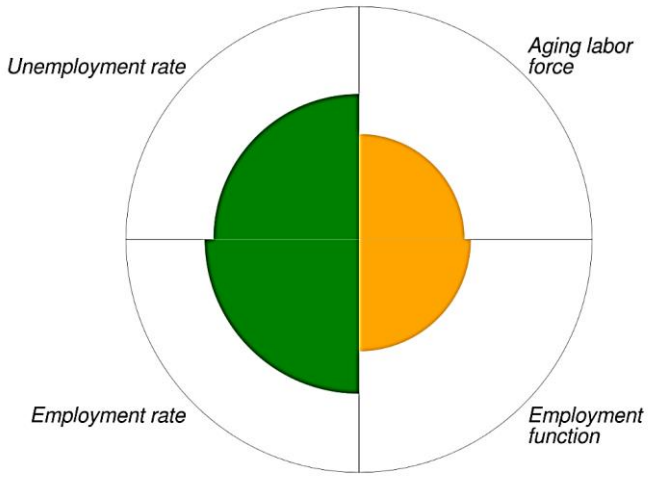
The results show a very favorable picture for Espoo. The expenditure on R&D is relatively high, as is the number of people that finished a tertiary level of education. Employment in the high tech sector is scoring very high and improves, but employment in the creative sector is a bit lower and decreasing.



Labor indicators

The stock Labor refers to the capability of people to contribute to the process of producing goods and services. The qualitative (knowledge, experience, creativity) and quantitative availability of people who can and want to work is a crucial economic factor. The functioning of the labor market is important to bring together supply and demand.

Employment rate in Espoo is high which represents the total employment divided by the potential labor force. Unemployment rate is relatively low in Espoo. On the other hand the ratio of employed people with an age above 55 years and the employed people in total (aging labor force) is relatively low. Also the score on employment function is relatively low. This is the number of people employed divided by the number of jobs within the city.



4.3.4 Summary of indicators with relatively low scores

The above presentation of the outcome at indicator level has shown that most indicators show a very favorable outcome. As Espoo is interested in possibilities to further improve its sustainability performance, attention will be particularly given to low scoring indicators that may be improved by means of policies developed by the city authorities.

The following 5 very low (red) scoring indicators are found in Espoo (table 4.1):

Table 4.1 Very low scoring indicators in Espoo, reporting year 2017

Social indicators	Ecological indicators	Economic indicators
	Emission NO_x	Satisfaction public transport
	Urban red area	
	Agricultural area	
	Incineration with energy recovery	

Nearly all very low scoring indicators are ecological ones.

In table 4.2 the 14 low (orange) scoring indicators are listed:

Table 4.2 Low scoring indicators in Espoo, reporting year 2017

Social indicators	Ecological indicators	Economic indicators
Municipal elections turnout	Concentration NO_2	Birth of business
Theaters	CO_2 reduction target	Employment growth
Museum visitors	Ecological status surface water	Aging labor force
Tourist overnight stays	Waste recycling	Employment function
Public libraries		
Hospital beds		

The lists in these two tables provide a potential priority list of policy actions. The list may however also contain indicators that are difficult or impossible to change or are based on the non-specific perception data shown for Espoo. Therefore a further analysis by the local authorities is required. Furthermore, the vicinity of Helsinki with e.g. its arts and culture facilities may make it acceptable for Espoo to score lower on such indicators.
Part of the background to select practical priorities is provided in the next chapter where the situation in Espoo is compared with the benchmark cities.

5 Comparison of Espoo with the group of benchmark cities

Judging the measurements for Espoo requires a suitable reference framework of benchmarking cities. Comparison with these cities can show how unique the situation in Espoo is and where Espoo can learn from approaches developed in other cities. A detailed analysis of Espoo's position for the low scoring indicators will also be presented.

5.1 Overall results for the benchmark cities in reporting years 2017 and 2016

Table 5.1 gives the outcome for reporting years 2017 and 2016 of the total group of 15 cities. It shows that most benchmark cities had higher total sustainability scores in 2017, but not all. Lower scores were found for not only Espoo, but also for Helsinki, Luxembourg, Munich and Tampere.

The top position of Espoo, which it retained in 2017, is not the outcome of a top position for all three capitals, as is shown in table 5.2. Actually, Espoo is not the best scoring city for each of the three capitals, but obtains its best position only for the combined total score. The best scoring position on the social capital goes to Luxembourg, for the ecological capital to Umeå and for the economic capital to Helsinki. These cities are scoring however lower on other capitals than Espoo.

Table 5.1 Overview of total sustainability and capital scores reporting years 2017 and 2016

	Total Score		Economic score		Ecological score		Social score	
City	**2017**	**2016**	**2017**	**2016**	**2017**	**2016**	**2017**	**2016**
Amsterdam	58.8	57.8	63.8	62.6	55.5	55	57.2	55.7
Antwerp	54.8	53.3	57.6	56	50	49.6	56.9	54.3
Berlin	55.2	54.5	54.5	54.2	59.7	59.6	51.4	49.7
Copenhagen	62.3	62.1	64.5	63.4	61.3	61.1	61.1	61.8
Eindhoven	56	54.7	64.9	63.4	47.1	46.8	56	54
Espoo	66.3	66.7	64.7	65.2	70.1	69.3	64.3	65.7
Helsinki	64.1	64.2	65.6	66	62.7	61.9	63.9	64.7
Innsbruck	62.7	62.4	60.8	59.5	61.9	61.8	65.5	65.9
Linköping	62.9	62.7	60.4	60.4	66.5	66.2	61.8	61.4
Luxembourg	59.3	59.8	58.1	58.7	52.8	52.9	67.1	68
Munich	62.2	62.6	62.5	62.9	59.5	59.6	64.6	65.4
Nuremberg	58.9	58.9	59.7	59.9	58.2	59.3	58.9	57.6
Stockholm	64.2	64	63.7	63.5	63	62.5	65.8	66.1
Tampere	62.5	62.9	57.2	57	68.8	68	61.7	63.8
Umeå	63.7	63.6	56.7	57.2	70.2	69.9	64.3	63.7

Table 5.2 Rankings of the benchmark cities for the total and capital scores in reporting year 2017

Total score		**Social capital**		**Ecological capital**		**Economic capital**	
Espoo	**66.3**	Luxembourg	67.1	Umeå	70.2	Helsinki	65.6
Stockholm	64.2	Stockholm	65.8	**Espoo**	**70.1**	Eindhoven	64.9
Helsinki	64.1	Innsbruck	65.5	Tampere	68.8	**Espoo**	**64.7**
Umeå	63.7	Munich	64.6	Linköping	66.5	Copenhagen	64.5
Linköping	62.9	**Espoo**	**64.3**	Stockholm	63	Amsterdam	63.8
Innsbruck	62.7	Umeå	64.3	Helsinki	62.7	Stockholm	63.7
Tampere	62.5	Helsinki	63.9	Innsbruck	61.9	Munich	62.5
Copenhagen	62.3	Linköping	61.8	Copenhagen	61.3	Innsbruck	60.8
Munich	62.2	Tampere	61.7	Berlin	59.7	Linköping	60.4
Luxembourg	59.3	Copenhagen	61.1	Munich	59.5	Nuremberg	59.7
Nuremberg	58.9	Nuremberg	58.9	Nuremberg	58.2	Luxembourg	58.1
Amsterdam	58.8	Amsterdam	57.2	Amsterdam	55.5	Antwerp	57.6
Eindhoven	56	Antwerp	56.9	Luxembourg	52.8	Tampere	57.2
Berlin	55.2	Eindhoven	56	Antwerp	50	Umeå	56.7
Antwerp	54.8	Berlin	51.4	Eindhoven	47.1	Berlin	54.5

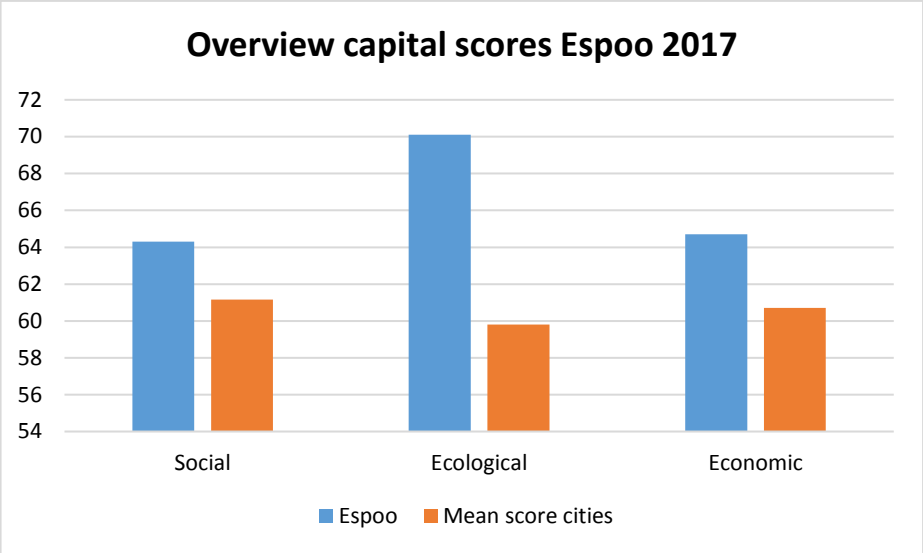


Figure 5.1 Capital scores for Espoo compared to the average score in 2017 of the benchmark cities

It is clear from figure 5.2 that Espoo is particularly exceeding the score of the benchmark cities for the ecological capital score. The least is the difference for the social capital score.

5.2 Stock scores for Espoo in comparison with the average scores of the other benchmark cities for reporting year 2017

Figure 5.2 shows in more detail where the sustainability performance of Espoo is better or worse than for the benchmark cities. Espoo is performing a little less than the group for Energy and climate, Resources and waste, Competitiveness and Health, while the difference is most striking for Arts and culture. Most of these stocks were also identified in the previous chapter.

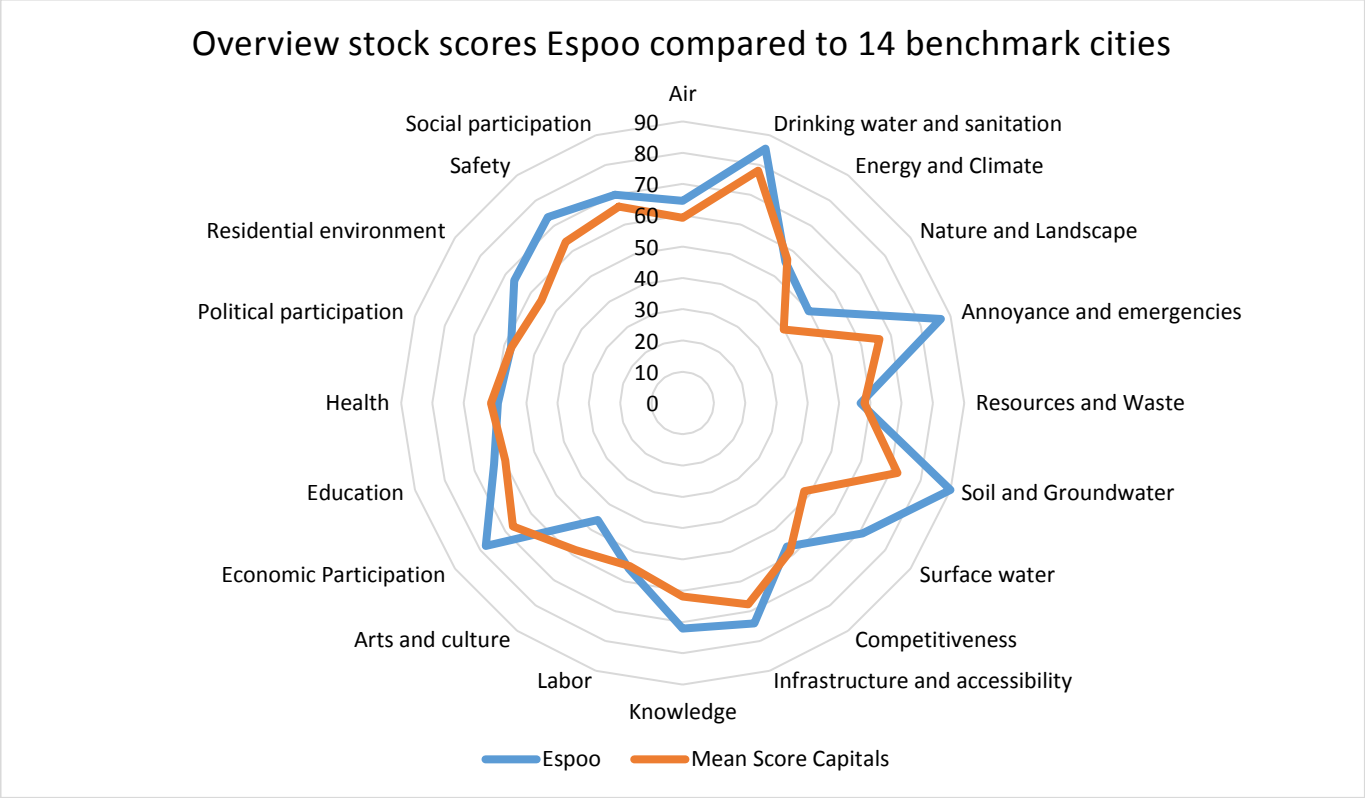


Figure 5.2 Overview of stock scores for Espoo compared with the other 14 benchmark cities

5.3 The broader perspective for assessing unfavorable scoring indicators in Espoo

Comparing the outcome of the 2017 assessment results in the benchmark group, a list of indicators which perform best and lowest in Espoo has been derived as shown in table 5.3.

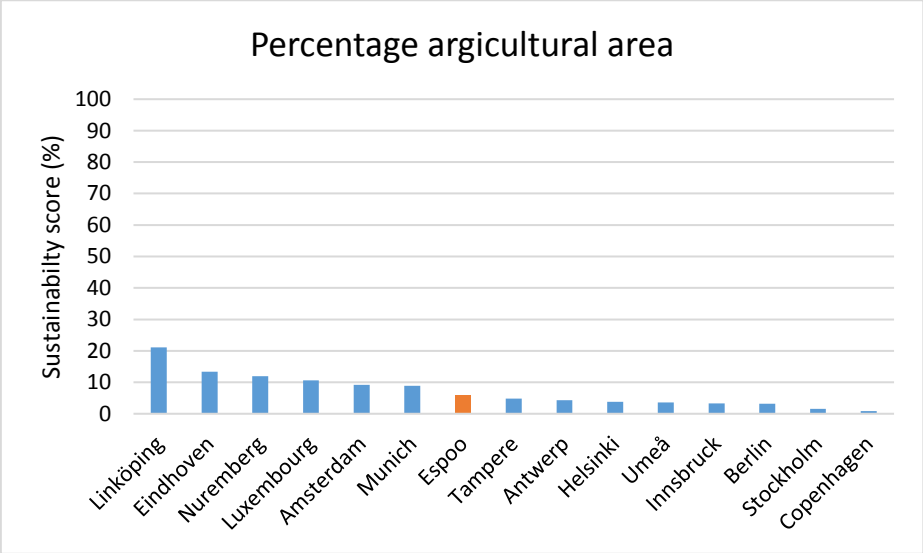
Table 5.3 Ten highest and lowest scoring indicators for Espoo compared to the benchmark group

Highest scoring Indicators	Lowest scoring Indicators
Waste water collected	Percentage of agricultural area
People connected to waste water treatment	Percentage of red area
Population exposed to airport noise	NOx emissions
Waste collected and Incineration	Recycling of municipal waste
Length of cycle lanes	Incineration with energy recovery
Chemical status of surface water	Presence of theaters

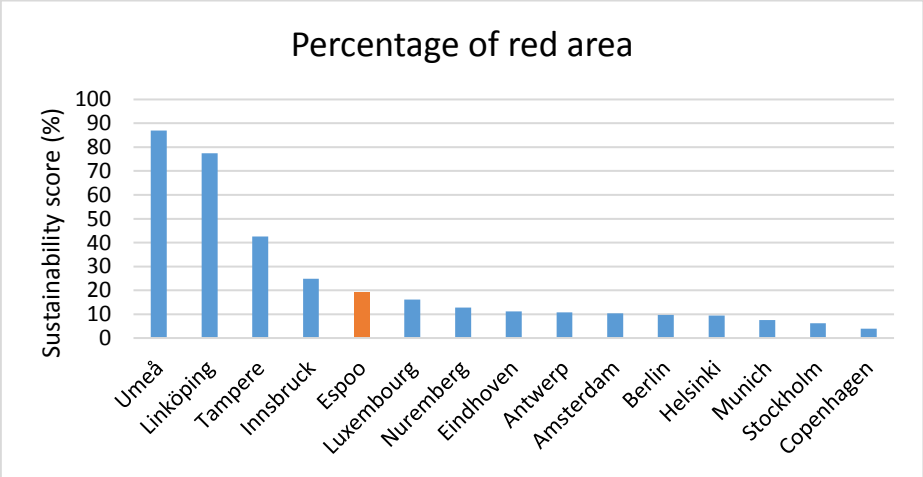
Soil system nitrogen	Presence of libraries
Trust in people	Hospital beds per capita
Chemical status of ground water	Birth of businesses
NH3 emission	CO2 Reduction target 2020

It is somewhat amazing that most of the unfavorably performing indicators for Espoo belong to the ecological capital, which is the strongest capital in Espoo. The same outcome was also found in the previous chapter. This result seems to be specific for Espoo. Below, the Espoo scores for these indicators are compared with the scores in the other benchmark cities to make this finding even more visible. These figures speak for themselves. At the end of this paragraph those indicators will be summarized where a specific Espoo situation may exist which could possibly be addressed by the city itself. From the indicators listed in table 5.3 the CO2 Reduction target 2020 is left out because Espoo has already in 2016 developed a new reduction target for 2030 which could not yet be included in the data for this monitor.

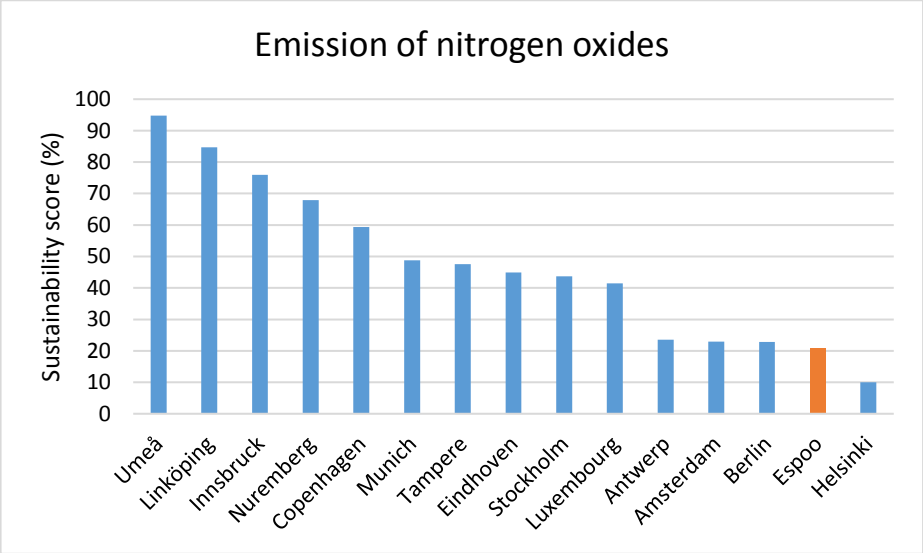
5.3.1 Percentage of agricultural area



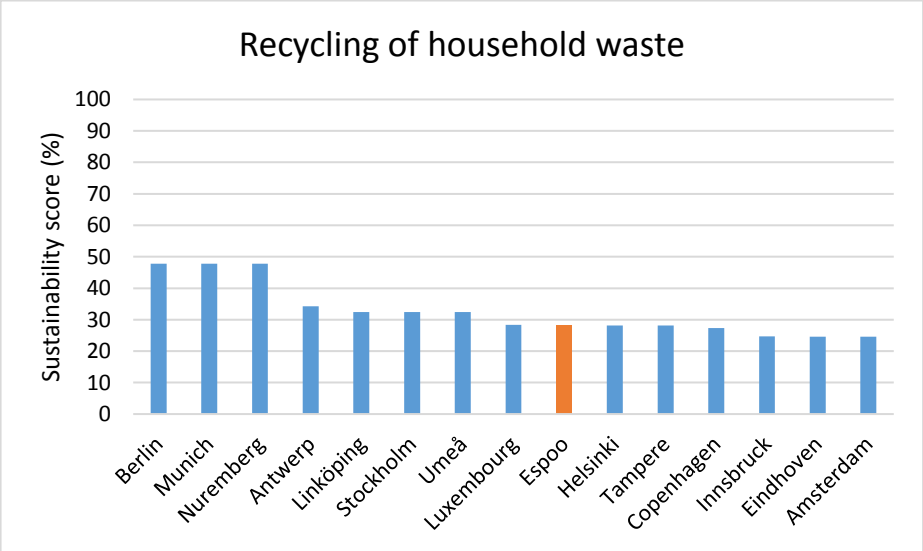
5.3.2 Percentage of red area



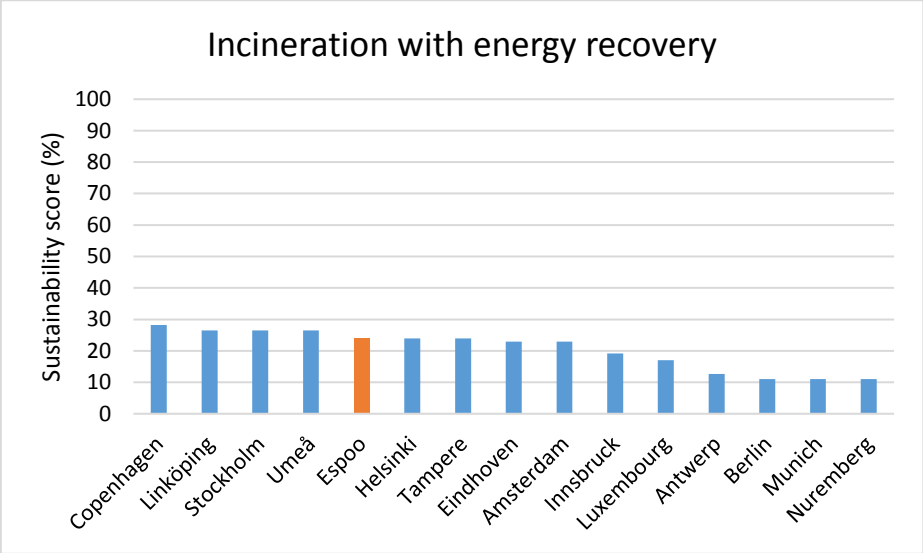
5.3.3 NOx emissions



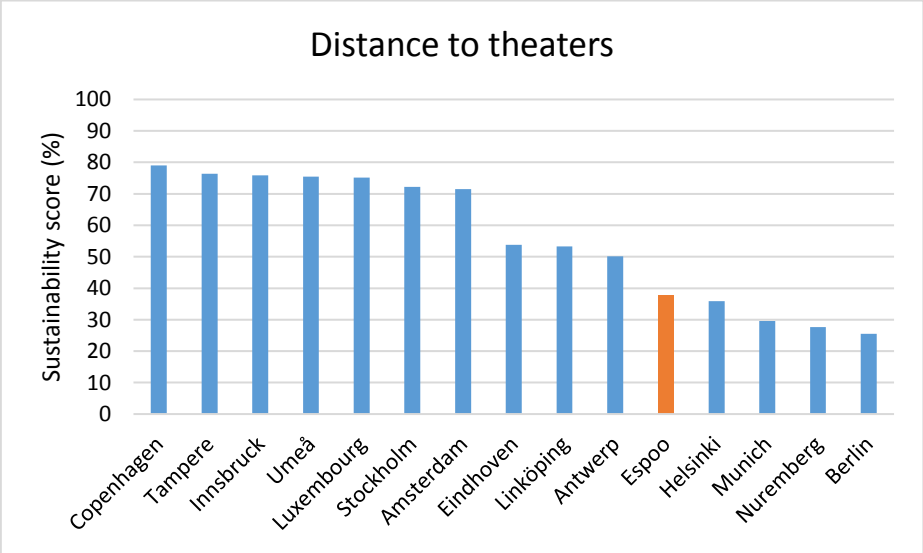
5.3.4 Recycling of municipal waste



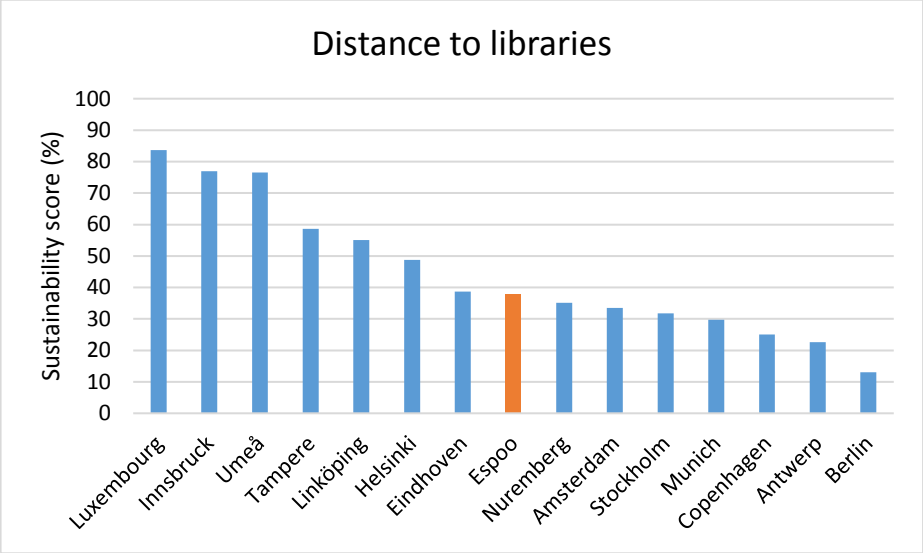
5.3.5 Incineration with energy recovery



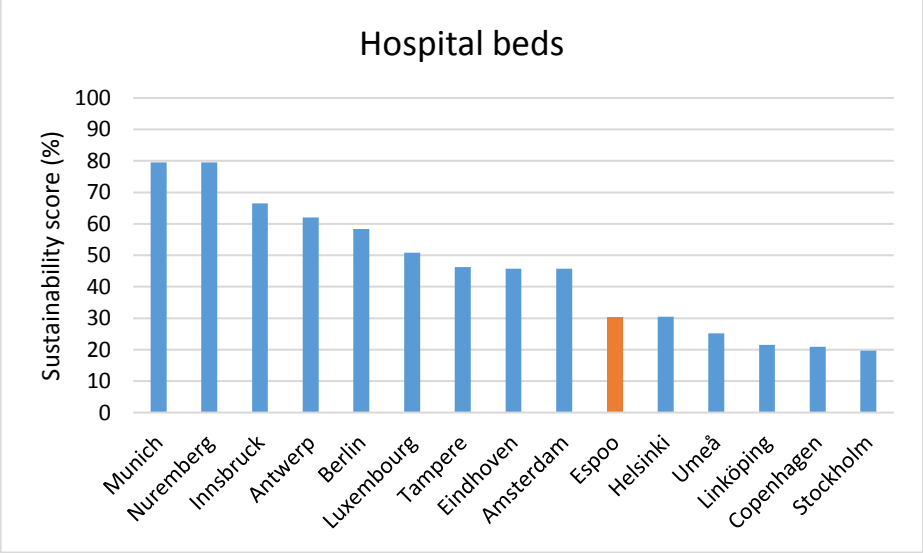
5.3.6 Distance to theaters



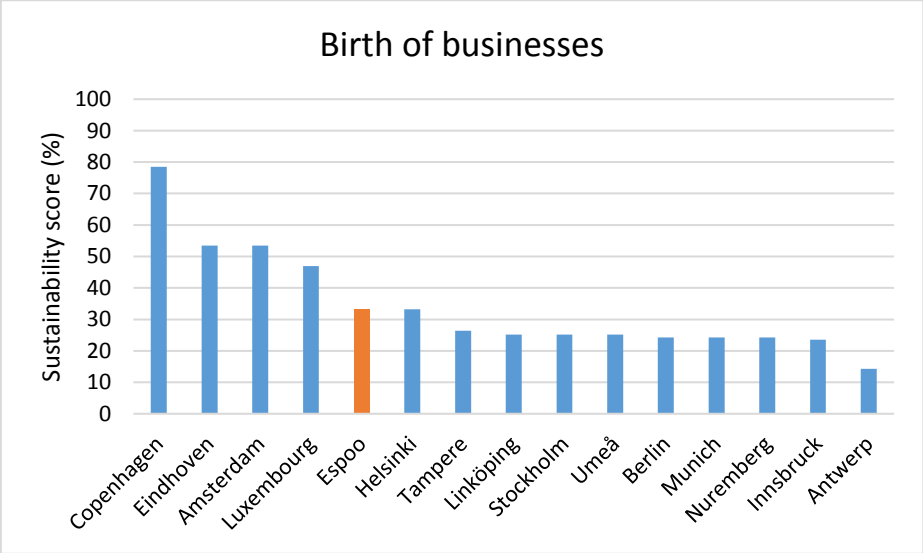
5.3.7 Distance to libraries



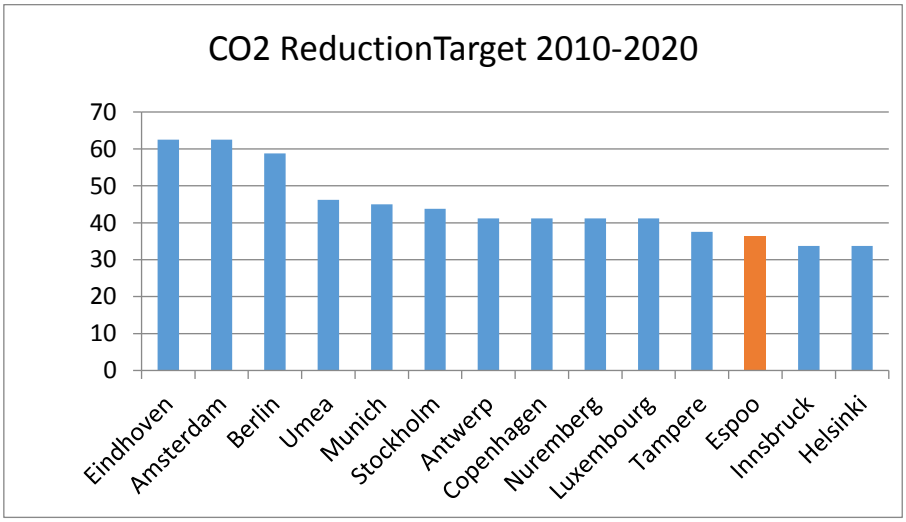
5.3.8 Hospital beds per capita



5.3.9 Birth of businesses



5.3.10 CO2 reduction target 2010-2020



5.3.11 Low performing indicators in Espoo of potential policy interest

Based on the figures shown above, the following indicators seem to be of special policy interest for Espoo because the low score is less found in the other benchmark cities:

- Nitrogen oxide emissions
- Availability of hospital beds
- Birth of new businesses
- Percentage of red area

- CO2 reduction target 2020

Indicators relating to the EU perception study are not included in this list as no actual perception data are collected in the framework of the EU in Espoo. The waste related indicators are also left out, as these are representing the national picture in order to be comparable with the outcome for other cities. A more detailed analysis in the Finnish context may show specific characteristics of the Espoo situation that can be further improved.

5.4 General discussion on the outcome of the benchmark group of cities

This paragraph will summarize the findings of the benchmark exercise.

Generally, Scandinavian cities in the benchmark group score higher on sustainability than the others. Part of this result is due to the more favorable ecological conditions, which is also true for Finland as a whole, as is shown in table 5.2.

Differences between city scores are most outspoken for the ecological capital, varying from 47.1 in Eindhoven till 70.2 in Umeå. Economic scores are varying least, from 54.5 in Berlin till 65.6 in Helsinki. The selection of the cities apparently was based on the common level of economic development.

At the level of stock scores variations between the cities, despite their similarity in economic development, can be high, e.g. for Air (46.0 in Antwerp and 81.8 in Umeå), Safety (35.2 in Antwerp and 80.0 in Munich), Social participation (40.7 for Antwerp and 82.3 for Copenhagen) and Soil and groundwater (20.2 in Eindhoven and 95.9 in Stockholm).

The stock Nature and landscape shows relatively low scores in all benchmark cities, with the exception of Linköping (60.8). Examples of lowest scoring cities are Eindhoven (12.8), Munich (30.2), Amsterdam (31.3), Stockholm (33.3) and Helsinki (36.7).

6 Recommendations for the case of Espoo

Based on the results of the analyses from different angles described above, a clear picture is emerging of typical sustainability aspects that can be considered for potential improvement in Espoo.

A way to combine the results discussed above is presented in figure 6.1. This figure shows the distribution of indicators according to their behavior on two criteria: the outcome of the benchmark comparison for Espoo and of the reporting period 2016-2017. The axes show if the Espoo indicators performed much lower, neutral, or higher in the two comparisons. Annexes 4 and 5 show the details of what is summarized in figure 6.1.

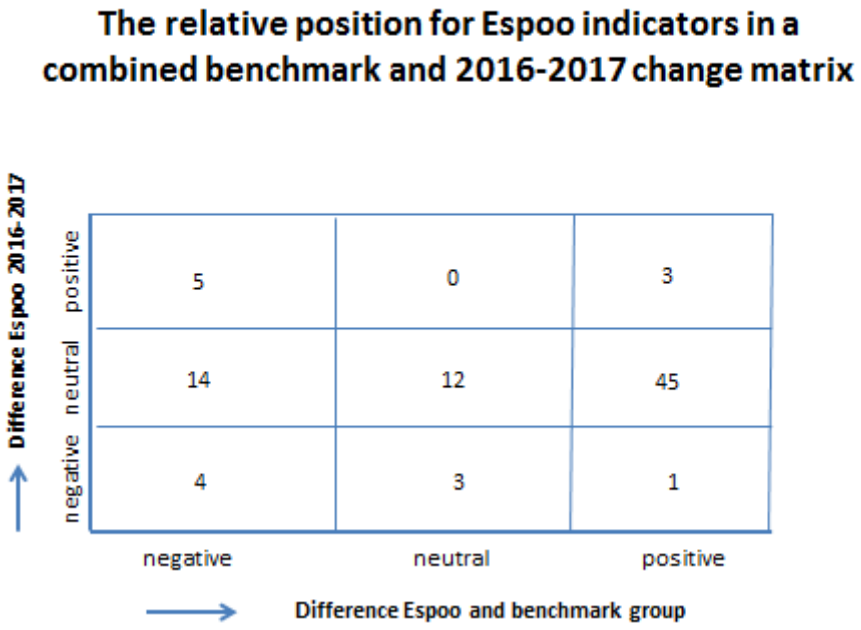


Figure 6.1 Overview of the relative position of Espoo's indicators in a combined matrix of results compared to the benchmark cities and to Espoo's performance in the previous year

Indicators of highest interest are those where Espoo performed unfavorably in comparison with the benchmark cities and showed a lower performance in 2017 than in 2016. The following 4 indicators belong to this group:

- Employment Growth
- Hospital beds available
- Satisfaction with hospitals
- Perception of foreigners

Lower scoring indicators in Espoo compared to benchmark cities that remained unchanged since the previous year (this can be also due to the absence of new measurements), are the following 14 indicators:

- NO2 concentration in air
- NOx emissions
- Reduction Target CO2 emission
- Agricultural Area
- Red Area
- Distance to airport
- Satisfaction with living in the city
- Employment Function
- Libraries
- Museum visitors
- Theaters
- Tourism overnight stays
- Municipal Elections turnout
- National Elections turnout

This outcome is the result of a desk study and not yet assessed against the background of practical circumstances in Espoo.
The Availability of hospital beds indicator, for example, is scoring low although high quality beds may be available at the moment in Espoo. The indicator is part of the SDG suggested indicators and therefore included in the analysis. Besides the quantitative aspect other considerations may have a decisive importance for Espoo.
For the CO2 reduction target 2020, the report has based itself on data reported in the framework of the Covenant of mayors. For reasons of comparability more recent decisions in 2016 to reduce CO2 emissions further have not yet been included in the report, but will improve the Espoo score further.
Similar detailed analyses may lead to selecting appropriate policy actions using the outcome presented as a potential checklist for action.

Where Espoo strives to further improve and maintain its top position in sustainability, the listed 18 indicators are good potential areas for policy action.

The 14 benchmark cities may have interesting approaches on these sustainability areas as has been identified in this study. Also more detailed analysis of the socio-economic and environmental interactions within and between Finnish regions may help find key potencies for improvement.

Considering the results in retrospect, some difficulties have become clear for which in the future better approaches may be developed.
1. It is a major drawback that Espoo is not included in the Perception survey of Eurostat. Obviously it is not very satisfactory to use estimates for the perception of sustainability issues in Espoo by using data from Oulu and Helsinki. It could be explored if Espoo can buy itself in in the periodic process of the EU perception survey.
2. When this monitor is used to monitor actual improvements and challenges of sustainability policy of Espoo and its region, it is not so helpful if data are used that are referring to the situation of several years ago. This could be overcome by e.g. organizing a tailor-made monitoring system among a group of participating cities that have a similar attitude towards sustainability and willingness to invest in a rapid exchange of data to support the governance of sustainability of their cities. This monitor can be a useful prototype for such an exercise.

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Annexes

Annex 1 Sustainability requirements for the stocks of the three capitals

Capital/ Stock	Requirements
Ecological capital	
Nature and landscape	Area covered by linked nature reserves. Preservation of biodiversity.
Soil and groundwater	Soil and groundwater are clean (for humans and wildlife). Preservation of the productive soil quality (for agriculture). No more water extraction than can be naturally replenished.
Drinking water and sanitation	Every household is connected to a public water supply and a sewer system with at least secondary treatment.
Air	Clean (for humans and wildlife). No adverse influencing of the climate.
Energy and climate	Cities show fast progress in a transition towards a zero carbon emission society.
Surface water	There is sufficient surface water and it is clean (for humans and wildlife).
Resources and waste	The extraction of non-renewable minerals is reduced.
Annoyance and emergencies	No unacceptable nuisance from odor, noise and dust. No unacceptable risk of calamities.
Social and cultural capital	
Social participation	There is social cohesion. There is no poverty or exclusion.

Political participation	Citizens are involved in politics (both passively and actively) and have access to the necessary information.
Economic participation	Everybody is able to buy essential requirements for life such as food, clothing and housing.
Health	The population is and perceives itself to be physically and spiritually healthy. Good quality health care is accessible to everyone.
Education	Education meets the needs of society, is of high quality and easily accessible to all.
Residential environment	People are satisfied with their own home and living conditions, public facilities and everyday necessities are accessible and within easy reach.
Safety	Everyone feels safe in the city because the risk of becoming a victim of crime or accident is negligible.
Arts and culture	There is a wide diversity of culture on offer, accessible to anyone who wishes to make use of it either actively or passively. The cultural heritage is protected and strengthened.
Economic capital	
Labor	There is balance on the labor market (in both qualitative and quantitative terms). The workforce is well trained. Work is healthy.
Infrastructure and mobility	Rail and road infrastructure provides fast and nearby possibilities for transport. The accessibility (via road, water, rail, air, and ICT) of companies, facilities and economic centers is good.
Knowledge	The innovative and creative capability of companies, organizations and people is constantly being strengthened. The knowledge institutions play an active, supportive role in this.
Competitiveness	The economic structure has a good mix of driving industries and service industries. They are constantly regenerated by the arrival of new enterprises (starter companies and enterprises newly locating to the area).

Annex 2 Indicator definitions and data used

Indicator	Definition	Year	Level	Source
1. Concentration PM10	Average yearly PM10 concentration within city limits in µg/m3	2012	City	EEA, Interpolated air quality data
2. NO2	Annual average concentration of NO2 (µg/m³)	2012-2013	City	Eurostat
3. Concentration PM2.5	Average yearly PM2.5 concentration within city limits in µg/m3	2012	City	EEA, Interpolated air quality data
4. Emission of ammonia	Total NH3 emissions in kg / km2 year	2000	City	The European Nitrogen Assessment
5. Emission of nitrogen oxides	Total NOx emissions in kg / km2 year	2000	City	The European Nitrogen Assessment
6. Exposure to ozone	Sum of ozone means over 35 ppb	2012	City	EEA, Interpolated air quality data
7. Perception of air quality	Percentage of people that indicated that they are satisfied with the air quality in the city	2015	City	Eurostat, Perception Survey/WOON-Enquête
8. Public water supply	Total water supply of a city in m3 per capita	2010	River Basin Districts	Eurostat
9. Waste water collected	Percentage waste water collected of total produced	2012	City	EEA, WISE Database
10. Waste water treated	Percentage of people connected to secondary or better waste water treatment	2012	City	EEA, WISE Database
11. Water consumption households	Total water consumption contributed to households in liter/day per capita	2010	River Basin Districts	Eurostat
12. CO2 Emissions	Greenhouse gas emissions in CO2 equivalents, in tons per capita	Various years (2008-2016)	City	Various (Local) Sources
13. CO2 Reduction realized	Realized CO2 reduction in the city between 1990 and 2010	2010	City	(Local) Sources
14. CO2 Reduction target	Target CO2 reduction in the city from 2010 and 2020	Various years	City	Various (Local) Sources
15. Agricultural area	Percentage of total area used for agricultural purposes	2006	City	EEA, Corine 2006 Database
16. Natura 2000 area	Percentage of total area indicated as protected Natura 2000 area	2015	City	EEA, Natura 2000 Database
17. Quality of nature	Percentage of the Natura 2000 area with a Good or Excellent quality status	2015	Natura 2000 area	EEA, Natura 2000 Database
18. Urban blue area	Percentage of area that is covered by water bodies and wetlands	2006	City	EEA, Corine 2006 Database

19. Urban green area	Percentage of area that is covered by forest and semi natural areas	2006	City	EEA, Corine 2006 Database
20. Urban red area	Percentage of area that is covered by artificial area	2006	City	EEA, Corine 2006 Database
21. Airport noise	Percentage of people that is exposed to noise above 55 dB from airports	2013	City	EEA, Noise map
22. Perception of noise level	Percentage of people that indicated that they are satisfied with noise level in the city	2015	City	Eurostat, Perception Survey/WOON- Enquête
23. Rail noise >65dB	Percentage of people that is exposed to noise above 65 dB from railroads	2013	City	EEA, Noise map
24. Rail noise >55dB	Percentage of people that is exposed to noise above 55 dB from railroads	2013	City	EEA, Noise map
25. Road noise >55dB	Percentage of people that is exposed to noise above 55 dB from roads	2013	City	EEA, Noise map
26. Road noise >65dB	Percentage of people that is exposed to noise above 65 dB from roads	2013	City	EEA, Noise map
27. Landfilling	Percentage of total waste collected that is processed by landfilling/disposal	2015	National	Eurostat
28. Incineration without energy recovery	Percentage of total waste collected that is processed by incineration/disposal	2015	National	Eurostat
29. Incineration with Energy recovery	Percentage of total waste collected that is processed by incineration with energy recovery	2015	National	Eurostat
30. Material recycling	Percentage of total waste collected that is processed by material recycling	2015	National	Eurostat
31. Municipal waste	Municipal solid waste, in kg per capita	Various years	City/ Nuts 2 / National	Various (Local) Sources
32. Chemical status ground water	Percentage of water bodies that have a good quality level for chemical status of groundwater	2012	River Basin Districts	EEA, WISE Database
33. Nitrogen surplus	Soil system nitrogen surplus for agricultural soils	2002	City	The European Nitrogen Assessment
34. Chemical status surface water	Percentage of water bodies that have a good quality level for chemical status of surface water	2012	River Basin Districts	EEA, WISE Database

35. Ecological status surface water	Percentage of water bodies that have a good or high quality level for ecological status of surface water	2012	River Basin Districts	EEA, WISE Database
36. Floodrisk due to rainfall	Change in annual mean number of days with extreme precipitation (> 20 mm/day) for 2071-2100	2015	City	EEA, Potential flood risk
37. Soil sealing	Soil sealing (paved area) in percentage of total area	2010	City	EEA, European Soil Sealing V2
38. Birth of businesses	Birth of businesses as a percentage of total active businesses	2013-2014	Nuts 3/National	Eurostat
39. Death of businesses	Death of businesses as a percentage of total active businesses	2013-2014	Nuts 3/National	Eurostat
40. Disposable income	Average disposable income per household	2013-2014	Nuts 2	Eurostat
41. Employment growth	Growth in employment rate in the past 5 years	2011-2015	Nuts 2	Eurostat
42. Labor productivity	GDP in PPS per employees	2014	Nuts 2	Eurostat
43. Broadband connections	Percentage of households with access to a broadband connection	2016	Nuts 2/Nuts 1	Eurostat
44. Congestion motorways	Kilometer motorway per registered car	2014	Nuts 2	Eurostat
45. Cycle lanes	Length of cycle lanes per capita	Various years (2010-2014)	City/Nuts 2	Eurostat/Fietsersbond
46. Distance to airport	Distance to closest major airport	2015	City	Travelmath
47. Registered cars	Total cars registered per capita	2014	Nuts 2	Eurostat
48. Satisfaction public transport	Percentage of people that indicated that they are satisfied with the public transport in the city	2015	City	Eurostat, Perception survey/WOON- Enquête
49. Employment creative sector	Percentage of employment in the creative class	2015	Nuts 2	Eurostat
50. Employment high-tech sectors	Percentage of active population employed in science and technology	2015	Nuts 2	Eurostat
51. R&D expenditure	Percentage of GDP invested in research and development	Various years (2013-2014)	Nuts 2	Eurostat
52. Tertiary education	Percentage of active population with at least tertiary education	2015	Nuts 2	Eurostat
53. Aging labor force	Percentage of the labor force older than 55	Various years	City	Eurostat

		(20011-2014)		
54. Employment function	Number of people employed divided by total number of jobs within the city	Various years (2008-2014)	City	Eurostat
55. Employment rate	Total employment divided by the potential labor force	Various years (2011-2014)	City	Eurostat
56. Unemployment rate	Percentage of the labor force which is unemployed	Various years (2009-2014)	City	Eurostat
57. Museum visitors	Museum visitors per capita	Various years (2008-2014)	City/Nuts 2	Eurostat/Museum vereniging
58. Public libraries	Number of public libraries per capita	Various years (2008-2014)	City/Nuts 2	Eurostat/Openbare-bibliotheek.nl
59. Satisfaction cultural Facilities	Percentage of people that indicated that they are satisfied with the cultural facilities in the city	2015	City	Eurostat, Perception Survey
60. Theaters	Number of theaters per capita	Various years (2008-2015)	City/Nuts 2	Eurostat/EM-Cultuur
61. Tourist overnight stays	Total nights spent in hotels per capita	Various years (2012-2015)	City/Nuts 2	Eurostat/CBS
62. Long term unemployment	Percentage of labor force that is unemployed for over 12 months	2015	Nuts 2/Nuts 1	Eurostat
63. Poverty rate	Percentage of people with a disposable income below poverty threshold	Various years (2011-2015)	Nuts 2/Nuts 1	Eurostat
64. Satisfaction with schools	Percentage of people that indicated that they are satisfied with schools and other educational facilities	2015	City	Eurostat, Perception survey/WOON-enquete
65. School dropouts	percentage of students who leave education without a diploma	2015	Nuts 2	Eurostat
66. Secondary education	Percentage of 25-64 years old with at least secondary education	2015	Nuts 2	Eurostat
67. Youth unemployment	Percentage of the labor force (15-24 years old) that is neither working nor in education	2015	Nuts 2	Eurostat
68. General practitioners	Doctors and physicians per capita	Various years (2012-2014)	Nuts 2	Eurostat

69. Hospital beds	Hospital beds per capita	Various years (2009-2014)	Nuts 2/ Nuts 1/ National	Eurostat/CBS
70. Infant mortality rate	Total deaths per 1000 live-births	Various years (2010-2014)	City	Eurostat
71. Life expectancy	Life expectancy at birth, in years	2014	Nuts 2	Eurostat
72. Satisfaction hospitals	Percentage of people that indicated that they are satisfied with healthcare services, doctors and hospitals	2015	City	Eurostat
73. European elections turnout	Turnout latest elections for European parliament	2014	City/ Nuts 2/ National	Eurostat/ EED-NSD/ Various (Local) Sources
74. Municipal elections turnout	Turnout latest elections for municipal council	Latest local election	City/national	Various (Local) Sources
75. National elections turnout	Turnout latest elections for national parliament	Latest local election	City/national	Eurostat/ EED-NSD/ Various (Local) Sources
76. Political trust	Percentage of people that indicated that public administration in the city can be trusted	2015	City	Eurostat, Perception Survey
77. Migration	Average annual net migration per 1,000 inhabitants	2015	Nuts 3	Eurostat
78. Rental price	Average annual rent for housing per m² - EUR	2016	City	Expatistan, Cost of Living Index
79. Satisfaction housing	Percentage of people that indicated that it is easy to find good housing at a reasonable price in the city	2015	City	Eurostat, Perception Survey
80. Satisfaction living in city	Percentage of people that indicated that they are satisfied to live in the city	2015	City	Eurostat, Perception Survey/WOON-enquete
81. Satisfaction sport facilities	Percentage of people that indicated that they are satisfied with Sports facilities in the city	2015	City	Eurostat, Perception Survey
82. Burglaries	Burglaries percapita	2010	Nuts 3	Eurostat
83. Intentional homicides	Intentional homicides per capita	2010	Nuts 3	Eurostat/CBS
84. Perception of safety	Percentage of people that indicated that they feel safe in the city	2015	City/ Dutch Safety-Area	Eurostat, Perception Survey/WOON-enquete
85. Robberies	Robberies per capita	2010	Nuts 3	Eurostat
86. Traffic fatalities	Traffic fatalities per capita	Various years (2011-2014)	City	Eurostat

87. Perception of foreigners	Percentage of people that indicated that the presence of foreigners is good for the city	2015	City	Eurostat, Perception Survey
88. Trust in people	Percentage of people that indicated that most people in the city can be trusted	2015	City	Eurostat, Perception Survey

Annex 3 Estimations of data in specific cases

Indicator	Remark
Public water supply consumption, household consumption	Data has been collected from Eurostat and from local sources. Examples of sources used are city statistical offices and city policy documents. Since different sources are used, it is possible that definition of data varies. For Innsbruck national numbers have been used for the public water supply consumption. For Oulu national numbers have been used for household consumption.
CO2 Emissions, CO2 reduction target	There is no source which provides data of these emissions on a regional level for all European regions. Therefore we had to collect data from local sources for this indicator. Examples of sources used are city statistical offices and city policy documents. Also the website of the Covenant of Mayors was used, as well as data from the Entracte Project.
Municipal waste	Data was collected mainly from the EEA and the CBS. Missing data from those sources, were collected from local sources. Examples of sources used are city statistical offices and city policy documents. Data was not always available on city level, and therefor sometimes nuts 2 or national data was used.
Landfilling, Incineration without energy recovery, Incineration with energy recovery and material recycling	There is no source which provides data of these indicators on a regional level for all regions. Therefor we used national sources for comparing these indicators
Road, Rail and Airport Noise	Data for these indicators is not available on a city level for all cities. For missing cities, the numbers are based on the average of the available cities in the same country.
Perception of air quality, Perception of noise level, Satisfaction public transport, Satisfaction cultural facilities, Satisfaction with schools, Satisfaction hospitals, Political trust, Satisfaction housing, Satisfaction living in city, Satisfaction sport facilities, Perception of safety, Perception of foreigners, Trust in people	Data of these indicators are taken from the Eurostat perception survey. Unfortunately, not all cities in our sample are included in this survey. In such cases data was copied from cities with data in the neighborhood with a similar typology. The following replacements have been made: For Espoo and Tampere we used the average of Finland For Umea we used the average of Sweden For Innsbruck we used the average of Austria For Linköping we used the average of Sweden For Nuremberg we used the average of Germany For Eindhoven, an approximation has been made based on the average of all the Dutch cities available in the Perception Survey. Although for 'perception of air quality', 'perception of noise level', 'satisfaction with schools', 'Satisfaction public transport', 'perception of safety' and 'satisfaction living in the city', data from the Woonenquete was used.
At-risk-of-poverty rate	For Belgium, Tampere (Finland) and Luxembourg, no data on the NUTS 2 level was found. For cities in those countries, NUTS 1 level data was used.
Cycle lanes	Data for the Dutch cities was not available. Therefor the data from 'Statistics Netherlands' was used. This data was however on NUTS 2 level.
Museum visitors, theaters, public libraries	No city level data was found for the Dutch cities. For the Dutch cities in the sample and the Dutch 100.000+ cities, NUTS 2 level data was used.
Tourist overnight stays	For The Netherlands we used NUTS 2 level data.
Broadband Connection	Nuts 2 level data was not available for the cities in Germany, NUTS 1 level data was used.

General Practioners	No NUTS 2 level data was found for Germany. So for the German cities, NUTS 1 level data was used.
Death and Birth of Businesses	Data for these indicators were not always available at Eurostat. For the cities in Belgium, Germany, Luxembourg and Sweden national data was used.

Annex 4 Higher and lower scoring indicators for Espoo in benchmark comparison and over the reporting period 2016-2017

	In comparison with average of benchmark group	In comparison with 2016
Birth of Business	-	●
Productivity Labor	-	●
Aging Labor Force	-	●
Unemployment	-	--
Life Expectancy	-	+
Migration	-	-
NO2	--	●
NOx	--	●
Reduction Target	--	●
Agricultural Area	--	●
Red Area	--	●
Landfill	--	++
Recycling	--	++
Employment Growth	--	--
Distance to Airport	--	●
Satisfaction Public Transport	--	++
Employment Function	--	●
Libraries	--	●
Museum	--	●
Theaters	--	●
Tourism	--	+
School Dropouts	--	++
Youth Unemployment	--	++
Hospital beds	--	--
Satisfied Hospitals	--	--
Muncipal Elections	--	●
National Electrions	--	●
Satisfaction City	--	-
Perception Foreigners	--	--
Water Collected	+	●
Incineration Final	+	●
Floodrisk	+	●
Disposable Income	+	+
Broadband Connection	+	●
Satisfaction Culture	+	--

Political Trust	+	--
Homocide	+	●
NH3	++	●
O3	++	●
Perception Air	++	++
PM10	++	●
PM25	++	●
Water Consumption	++	●
Water Supply	++	●
Greenhouse	++	●
Blue Area	++	●
Green Area	++	●
Natural Quality	++	●
Nature2000	++	●
Airport Noise	++	●
Perception Noise	++	++
RailNoise55	++	●
RailNoise65	++	●
RoadNoise55	++	●
RoadNoise65	++	●
Incineration Energy	++	-
Total Waste	++	●
GW_Chemical	++	●
Nitrogen Soil	++	●
Soil Sealing	++	●
SW_Chemical	++	●
SW_Ecological	++	●
Death of Businesses	++	●
Congestion Motorway	++	●
Lenght Cycle Lanes	++	●
Registered Cars	++	●
Employment Creative Class	++	--
Employment High Technology	++	+
High Education	++	+
RD Expenditure	++	●
Employment Rate	++	●
Unemployment Rate	++	●
Poverty	++	●

Satisfied Schools	++	-
Secondary Education	++	+
General Practitioners	++	●
Infant Mortality	++	●
European Elections	++	●
Rental Price	++	+
Satisfaction House	++	++
Satisfaction Sport	++	-
Burglary	++	●
Fatalities	++	●
Perception Safety	++	-
Robbery	++	●
People Trust	++	-
Water Treated	●	●

Annex 5 Rearranged higher and lower scoring Espoo indicators in benchmark comparison and over the reporting period 2016-2017

Change over 2016-2017	POSITIVE	• Landfill (waste) • Recycling (waste) • School dropouts • Youth unemployment • Satisfaction public transport		• Perception Air • Perception noise • Satisfaction house
	NEUTRAL	• NO2 • NOx • National elections • Reduction Target CO2 • Agricultural Area • Red Area • Distance to airport • Satisfaction living in the city • Employment Function • Libraries • Museum' • Theaters • Tourism • Municipal Elections	• Birth of Business • Productivity Labor • Aging Labor Force • Life Expectancy • Water Collected • Incineration with energy • Flood risk • Disposable Income • Broadband Connection • Homicide • Water Treated • Migration	• NH3 • O3 • PM10 • PM2.5 • Water Consumption • Water Supply • Greenhouse CO2 • Blue Area • Green Area • Natural Quality • Nature 2000 • Airport Noise • Road Noise above 55dB • Road noise above 65dB • Incineration without Energy • Total Waste • Ground water chemical • Nitrogen Soil • Soil sealing • Surface water chemical • Surface water ecological • Death of Business • Congestion Motorway • Length of Cycle Lanes • Registered Cars • Employment High technology • High Education • R&D Expenditure • Employment Rate • Unemployment Rate • Poverty • Satisfaction Schools • Secondary Education • General Practitioners • Infant Mortality • European Elections • Rental Price • Satisfaction Sport • Burglary • Fatalities • Robbery • People Trust • Rail noise above 55dB • Rail noise above 65dB • Perception safety
	NEGATIVE	• Employment Growth • Hospital beds available • Satisfaction hospitals • Perception foreigners	• Unemployment • Political trust • Satisfaction culture	• Employment Creative Class
		NEGATIVE	NEUTRAL	POSITIVE
BENCHMARK 15 CITIES				

Annex 6 shows an overview of cities where a specific indicator is scoring higher than in Espoo. This overview can be used to search for possible sources of inspiration to further improve the situation in Espoo

	Inn	Ant	Cop	Hel	Tam	Ber	Mun	Nur	Lux	Ein	Ams	Lin	Sto	Umeå
NO2			x	x	x							x	x	x
NH3			x		x									x
NOx	x	x	x		x	x	x	x	x	x	x	x	x	x
O3		x		x	x						x		x	x
PerceptionAir														
PM10												x		x
PM25			x		x							x		x
WaterCollected														
WaterConsumption														
WaterSupply		x	x		x	x	x	x						
WaterTreated														
Greenhouse			x	x						x			x	
RealisedReduction		x	x		x	x	x	x	x	x	x		x	x
ReductionTarget							x	x	x	x	x	x		
AgriculturalArea		x			x						x	x	x	
BlueArea	x				x							x		x
GreenArea	x		x		x		x		x			x		
NaturalQuality	x	x				x		x	x					
Nature2000	x				x							x		x
RedArea														
AirportNoise														
PerceptionNoice														x

RailNoise55														x
RailNoise65					x	x	x	x					x	x
RoadNoise55													x	x
RoadNoise65	x	x	x			x	x	x		x	x	x	x	x
Landfill														
IncinerationFinal			x									x	x	x
IncinerationEnergy		x				x	x	x	x			x	x	x
Recycling			x			x	x					x		x
TotalWaste	x				x							x	x	x
GW_Chemical			x	x		x							x	
NitrogenSoil														
Floodrisk	x				x							x		x
SoilSealing	x				x		x							
SW_Chemical														x
SW_Ecological			x						x	x	x			
BirthBusiness		x			x									
DeathBusiness							x	x	x				x	
DisposableIncome	x	x	x		x	x	x	x	x	x	x	x	x	x
EmploymentGrowth		x	x				x		x		x		x	
ProductivityLabor									x	x	x		x	
BroadbandConnection	x								x			x		
CongestionMotorway	x	x	x	x		x		x	x	x	x	x		x
DistanceAirport												x		
LenghtCycleLanes	x				x		x	x	x	x				x
RegisteredCars	x	x	x	x		x	x	x	x	x	x	x	x	x
SatisfactionPublicTransport			x			x					x			
EmploymentCreativeClass														
EmploymentHighTechnology														
HighEducation			x				x							
RDExpenditure	x	x	x	x	x		x			x	x		x	
AgingLaborForce	x	x	x	x	x	x	x	x		x	x	x	x	x
EmploymentFunction											x			
EmploymentRate							x			x				
UnemploymentRate	x			x	x				x	x		x		x
Libraries	x	x	x	x	x	x	x	x	x		x	x	x	x
Museum	x			x			x					x		x

SatisfactionCulture	x	x	x		x					x	x	x	x	x	x
Theaters	x		x			x	x	x	x	x	x	x	x	x	x
Tourism															
Poverty	x		x				x	x	x			x	x	x	
Unemployment		x													
SatisfiedSchools	x	x	x				x	x			x	x	x	x	
SchoolDropouts							x								
SecondaryEducation	x		x				x	x	x	x	x	x	x	x	
YouthUnemployment	x					x					x		x		
GeneralPractitioners	x	x			x	x	x	x	x	x	x				
Hospitalbeds															
InfantMortality	x	x					x		x			x	x		
LifeExpectancy	x	x	x	x		x	x	x	x	x	x	x	x	x	
SatisfiedHospitals		x	x						x				x		
EuropeanElections		x				x			x			x	x	x	
MuncipalElections		x	x	x					x			x	x	x	
NationalElectrions	x		x				x		x			x	x	x	
PoliticalTrust	x		x			x	x	x	x		x		x		
Migration									x						
RentalPrice	x		x				x	x	x	x	x	x	x	x	
SatisfactionCity										x					
SatisfactionHouse															
SatisfactionSport							x	x						x	
Burglary				x	x							x			
Fatalities			x			x	x	x	x			x	x	x	
Homocide			x				x						x		
PerceptionSafety					x		x							x	
Robbery															
PeopleTrust			x	x		x	x	x	x	x	x	x	x	x	
PerceptionForeigners	x		x	x		x	x	x	x	x	x	x	x	x	